ASP®
Manual

THORN
Airfield Lighting

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GROUP

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ASP®

CHAPTERS AND APPENDICES

CONTENTS

Section	**Description**
Preface	ASP Introduction
1.	ASP System General Description
2.	AMT Pro-Basic user's guide
3.	SFU User's Guide
4.	LPU-LPC User's Guide
5.	SCF User's Guide
6.	SCM Rack - User's Guide
7.	SIU User's Guide
8.	LMS User´s Guide
9.	MBD User's Guide
10.	NCU User's Guide
11.	ASP-system power line communication
12.	International Standards Compliancy List
13.	Case Description Turn-key ASP
14.	ASP Modbus Interface
15.	ASP System Preventive Maintenance
16.	ASP Troubleshooting and Maintenance

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INTRODUCTION
This manual has been compiled to give the reader an understanding of installation, operation and maintenance (IOM) procedures of Airfield Smart Power ASP®, with a focus on safety and efficiency.

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HISTORY

Version	**Date**	**Description**
1.0	June 2010	First Release

ORIGINAL DOCUMENTS
The following is a list of original documents used to create this manual.

File Name	Description
ASP_INTRODUCTION	Introduction General Information
1. SG591890-3007A ASP System General Description	ASP System General Description
2. SG591891-3006D AMT Pro-Basic user's guide	AMT Pro-Basic user's guide
3. 591876-3001 SFU User's Guide	SFU User's Guide
4. SG591862-3001 LPU-LPC User's Guide	LPU-LPC User's Guide
5. SG591870-3002 SCF User's Guide	SCF User's Guide
6. SG591883-3002B SCM Rack - User's Guide	SCM Rack - User's Guide
7. SG591885-3018A SIU User's Guide	SIU User's Guide
8. SG591886-3020A LMS User´s Guide	LMS User´s Guide
9. SG596530-3011D MBD User's Guide	MBD User's Guide
10. SG591943-3004A NCU User's Guide	NCU User's Guide
11. ASP-system power line communication	ASP-system power line communication
12. SG591890-3006 International Standards Compliancy List	International Standards Compliancy List
13. SG591890-3013 Case Description Turn-key ASP	Case Description Turn-key ASP
14. SG591890-3023H ASP Modbus Interface	ASP Modbus Interface
15. SG591890-3014 ASP System Preventive Maintenance	ASP System Preventive Maintenance
16. SG591890-3004 ASP Troubleshooting and Maintenance	ASP Troubleshooting and Maintenance

***Note**: This page is to be updated with every authorised change to the manual.*

SAFETY INFORMATION

The airfield smart power (ASP) system is for airport safety and efficiency. The design is according to strict airport industry standards for the safety of, and use by authorised airport personnel.

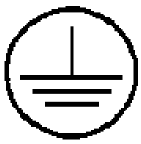
Airport Operations, Maintenance and other Authorised Personnel

This information is a summary of the safety requirements on operation and maintenance personnel based on general electrical and safety precautions.

***Note**: It is very important for authorised personnel to study this section before any operation or maintenance work on the system is commenced.*

ASP® should only be used by airport operations and maintenance personnel who have been properly trained in the use of the system. Safegate takes no responsibility for incorrect use of the system. All warnings contained in the text of this manual must be strictly observed.

Airport operations and maintenance personnel are strongly advised to observe the following symbols and safety advisories.

Symbol	Safety Advisory
	ASP® contains electrical circuits and devices, which may be hazardous to operators and maintenance personnel, if proper safety precautions are not observed. Only properly trained personnel should open enclosures or attempt to perform maintenance on these devices. Personnel are cautioned to read and thoroughly understand this manual before attempting to service any part of the system.
	ASP® contains 100 - 230 VAC electrical circuits that may be hazardous to operators or maintenance personnel if proper safety procedures are not observed. Shut down power before attempting to service the system. Power may be turned off at the main disconnect circuit breaker or at the breaker panel supplying AC power to the unit or system. ***CAUTION**: SOME SYSTEMS ARE SUPPLIED WITH A REMOTE UPS, WHICH MAY CONTINUE TO SUPPLY POWER TO THE SYSTEM, EVEN WHEN THE BREAKER AT THE SUPPLY PANEL IS SWITCHED OFF. BE SURE TO REMOVE ALL POWER, BEFORE SERVICING THIS EQUIPMENT.*
	A chassis ground connection is provided in some parts of the system. Be sure to follow all applicable codes in making chassis ground connections.

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ABBREVIATIONS

Abbreviation	Description
AC	Alternate Current
ACC	Apron Control Centre
ALB	Aircraft Loading Bridge
ASP	Airfield Smart Power
ATA	Actual Time of Arrival
ATD	Actual Time of Departure
A-SMGCS	Advanced Surface Movement Guidance & Control System
A-VDGS	Advanced Visual Docking Guidance System
CCR	Constant Current Regulator
CL	Centre Line
COTS	Commercial Off-the-shelf Items
CPU	Central Processing Unit
CR	Communication Room
CU	Control Unit of Docking System
CU	Concentrator Unit
DC	Direct Current
DGS	Docking Guidance System
ESD	Electrostatic Discharge
ETA	Estimated Time Of Arrival
ETD	Estimated Time Of Departure
FAT	Factory Acceptance Test
FIDS	Flight Information and Display System
GMS	Gate Management System
GOS	Gate Operating System
HMI	Human Machine Interface
I/O	Input/ Output
ICD	Interface Control Document
IOM	Installation Operation Maintenance
ISO	International Standardisation Organisation
IT	Information Technology
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LMS	Light Monitor- and Switch unit
LRU	Line Replaceable Unit
MDT	Mean Down Time
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NTP	Network Time Protocol
OP	Operator Panel unit

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Abbreviation	Description
PBB	Passenger Boarding Bridge
PCB	Printed Circuit Board
PD	Pilots Display unit
PLC	Programmable Logic Controller
P/N	Part-number
QCP	Quality Control Plan
RAM	Random Access Memory
RH	Relative Humidity
RVR	Runway Visual Range
SAT	Site Acceptance Test
SBU	Safety Back-up
SCF	Series Circuit Filter
SCM	Series Circuit Modem
SMGCS	Surface Movement Guidance & Control System
SSU	System Switch Unit
S/N	Serial Number
SQL	Structured Query Language
STA	Scheduled Time of Arrival
STD	Scheduled Time of Departure
TCP/IP	Transmission Control Protocol/Internet Protocol
U/S	Unserviceable/ Out of Service
UPS	Uninterruptible Power Supply

ASP®-System Concept

General Description

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CONTENTS

1 Revision History ... 3
2 Scope ... 3
3 Abbreviations ... 3
4 References ... 4
5 Introduction ... 4
6 Basic System Characteristics ... 4
6.1 The LMS ... 4
6.2 The SIU ... 5
6.3 The SCM and CU ... 5
6.3.1 Redundant CU ... 5
6.4 The SCF ... 5
6.5 Control System Interface ... 5
6.6 Flexibility ... 6
6.7 Availability ... 6
6.8 Installation Requirements and Maintainability ... 7
6.9 Failsafe Operation ... 7
7 Communication Principles ... 8
7.1 System Response Times ... 9
7.1.1 Stop Bar Response Time ... 9
7.1.2 Lamp Monitoring Response Time ... 9
7.1.3 Command Sequence Response Time ... 9
8 Appendices ... 10
8.1 Elements Of Importance ... 10
8.1.1 Field Equipment ... 10
8.1.1.1 Power Consumption ... 10
8.1.1.2 Encapsulation ... 10
8.1.1.3 Sensor Interfacing ... 10
8.1.1.4 Communication Technique ... 11
8.1.1.5 System Configuration ... 11
8.1.1.6 Functionality ... 12
8.1.1.7 Flexibility ... 13
8.2 Vault Equipment ... 13
8.2.1.1 Installation ... 13
8.3 System Response Times ... 14
8.3.1.1 Single Command Response Time ... 14
8.3.1.2 Sensor Response Time ... 14
8.3.1.3 Failed Lamp Response Time ... 14
8.3.1.4 Multi Segment Response Time ... 14

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1 REVISION HISTORY

Ver	Date	Remark	Author
0.1	020130	Document created, draft.	JF
0.2	020130	Added Appendices.	OH
1.0	020204	Issued.	OH
1.1	050121	Added details in chapter 8.1	JF

2 SCOPE

This document is intended to provide a general description of the ASP®-System concept provided by Safegate.

3 ABBREVIATIONS

ASP	Airfield Smart Power
LMS	Light Monitor- and Switch unit
SIU	Sensor Interface Unit
SCM	Series Circuit Modem
SCF	Series Circuit Filter
CU	Concentrator Unit
SSU	System Switch Unit
PLC	Programmable Logic Controller
CCR	Constant Current Regulator
SMGCS	Surface Movement Guidance Control System
A-SMGCS	Advanced SMGCS

4 REFERENCES

SG591835-3013 LMS User’s Guide
SG591870-3002 SCF User’s Guide
SG591880-3003 SCM-Rack User’s Guide
SG591885-3018 SIU User’s Guide
SG591847-3017 CU User’s Guide
SG591852-3018 SSU User’s Guide
SG591890-3006 International Standards Compliancy List

5 INTRODUCTION

The ASP®-System is designed to provide individual monitoring of airfield lighting using the series circuit as a means of communication for the lamp and sensor status information coming from the airfield. The same concept is used for lighting control, and as such provides the foundation for an SMGCS or A-SMGCS which includes for example automation of *stop bars* with or without sensors, taxiway guidance (routing), both in combination with status monitoring.

The ASP-System is a cost effective solution for upgrading existing or new series circuits with selective switching and/or individual monitoring of all or a selected number of lights in an airfield.

6 BASIC SYSTEM CHARACTERISTICS

Refer to Figure 1 for reference. For more detailed information regarding the ASP-System components refer to the individual User’s Guides.

6.1 The LMS

The ASP®-System, using the *LMS* concept, is designed to provide selective switching and/or monitoring of airfield lighting by use of an addressable switching unit at each individually controlled light. This switching unit is the LMS. The LMS is connected to the secondary side of a standard series circuit isolation transformer, connected to the series circuit, and uses standard 2-pin FAA-style connectors for its connection between isolation transformer and the attached light fixture. Communications to/from the LMS uses a unique power line communication technique developed by Safegate where the communication signals are superimposed on the series circuit current.

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6.2 The SIU

Sensors for presence- and direction detection of aircraft and vehicles on the airfield can easily be interfaced to the ASP-System using an *SIU*. The SIU communicates the detect/no-detect status signals as well as its own status to the series circuit in the same manner as the LMS. The SIU is also connected the secondary side of a standard isolation transformer using the standard 2-pin FAA-style connectors while its connection to the sensor is established using an IP68 rated 7-pin connector. The SIU can supply the sensor with a DC-voltage since it also includes a current to voltage converter.

6.3 The SCM and CU

The *CU*, as its name suggests, concentrates all status information coming from the field, i.e. both lamp and sensor status. It transfers commands to the *SCM*, which constitutes the interface to the series circuit. The SCM interfaces to the series circuit through a standard isolation transformer and to the CU via standard RS485 or RS232 serial communication.

6.3.1 Redundant CU

The *SSU* is included in an ASP-System in order to introduce redundant CU control functionality of the associated SCMs. Its role is to control the switching of the CU-to-SCM communications between the *active* CU and the SCMs.

6.4 The SCF

The *SCF* is connected across the CCR series circuit output and is used to contain the communication signalling within the airfield circuit and minimize feedback into the regulator.

6.5 Control System Interface

The CU operates as the ASP®-System main interface interpreting commands sent from the Host/Supervisor System (including the Safegate *SafeControl*-system) and in turn controlling the appropriate LMS lighting as directed. It maintains all lighting and error status as well as that of sensor detections as reported from the airfield components and thus is the central point of the ASP-System as operated from each vault. As such, individual lights can be grouped in lighting segments spanning one or more series circuits, for example an interleaved stop bar. In turn, the CU provides alarm status for percentage and adjacent lamp failure within those defined lighting segments per requirements for low visibility operations. Airfield lighting and ASP®-System component status are constantly monitored and updated to the Host/Supervisor system upon occurrence.

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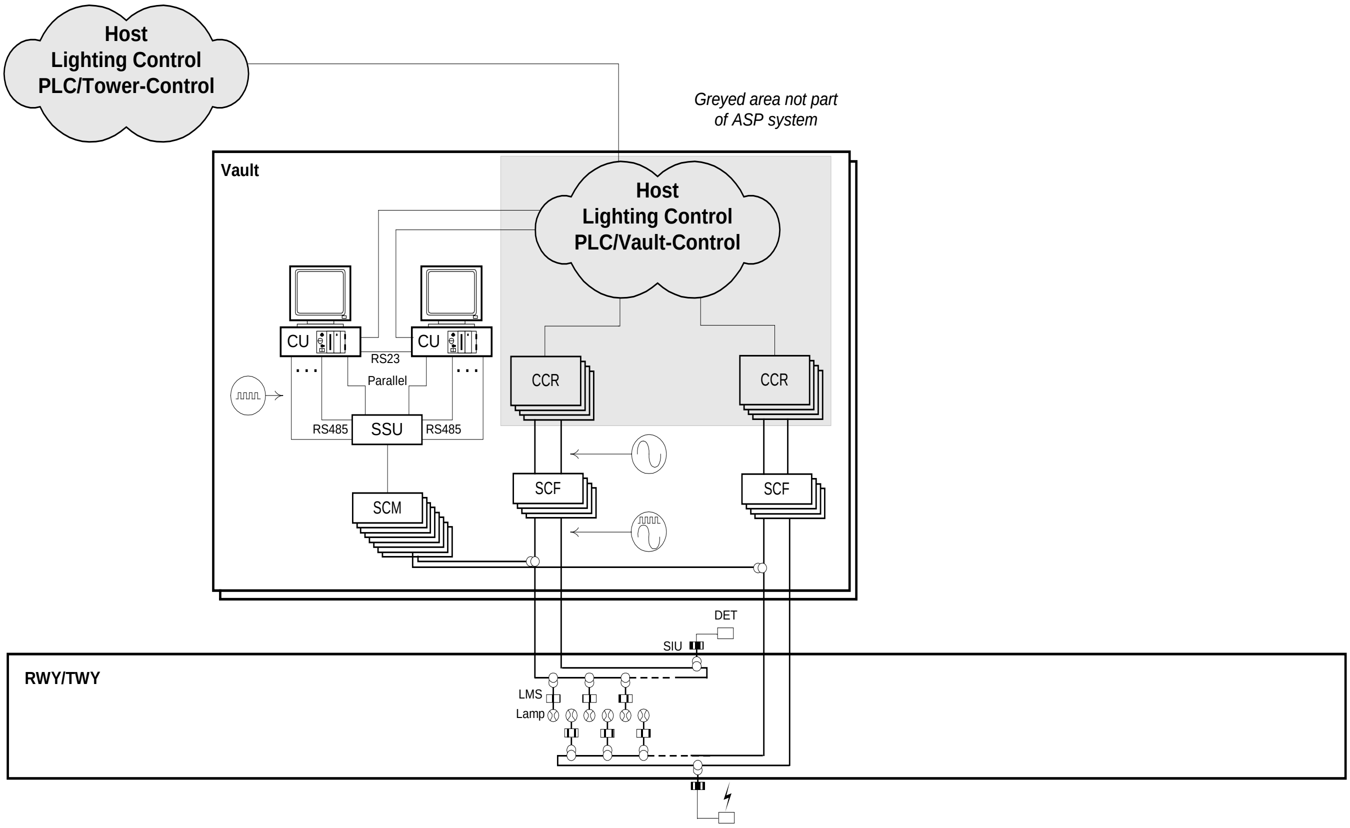

Figure 1 ASP-System block diagram (redundant CU-configuration depicted).

6.6 Flexibility

The fact that the segmentation of lights into selectively controlled blocks is made in software, and not by means of cables and CCRs or selector switches, reduces the installation and hardware costs substantially and at the same time increases the flexibility of the airfield lighting system. A segment can easily be redefined or added in the software, with possible addition of isolation transformers and LMSs in the airfield. Not all lights on a series circuit need to be equipped with LMSs, only the ones that need to be monitored/controlled.

The ASP®-System is designed to be modular and expandable, so that it can be readily modified to monitor and control additional lighting functions and series circuits.

6.7 Availability

The series circuit cable transfers power to the lamp on the circuit and the same physical channel is used by the ASP®-system for communication. This implies that whenever there is power available to the lamps, the ASP®-system will have access to its communications channel and control and monitoring will be available. A discontinuity on the cable shield will not normally influence neither the light's nor the ASP®-system's availability.

The system is designed to operate without repeaters, which boosts availability considerably compared to systems that require them.

6.8 Installation Requirements and Maintainability

The ASP®-system's electrical requirements on a series circuit level are the same as a light fitting's or an isolation transformer's[1]. Thereby the ASP®-System does not put any additional constraints on how the installation is done and hence there is no conflict with for example electrical safety code and general or local standards when installing this type of system. The Safegate ASP®-system may be used on shielded as well as unshielded cables and there are no constraints when it comes to grounding the shield since it's not used by the system.

High voltage equipment (connected to the primary of the series circuit) and low voltage equipment (connected to the secondary of the series circuit) are physically separated. By separating them, the impact on system availability and person hazards as a consequence of maintenance efforts, is minimized.

6.9 Failsafe Operation

If a fault is detected on any system component at any time, the CU will provide this information to the Host-System upon occurrence so that the appropriate actions may be taken. These actions would typically be that of displaying a message to the maintenance station terminal and, if necessary, some indication at the operator terminals to signify any interference to operations.

In normal operations, the ASP® lighting appears on the airfield as commanded by the Host-System. When there is an equipment or communications failure associated with the ASP®-System, the associated airfield lighting adopts the failsafe or "safe-state" setting. This can happen on an individual circuit basis or the entire airfield depending upon one or more of the following circumstances:

1. **A "Set Failsafe" command is given by the Host-System:** The CU sets airfield lighting to a predefined failsafe state as commanded by the Host-System. The airfield remains in this state under Host-System control until the airfield lighting is commanded to another state.
2. **Loss of communications with the Host-System:** The CU assumes an error in the Host-System control and sets airfield lighting to its predefined Failsafe state. The airfield remains in this state under ASP®-System control until communications is restored with the Host-System AND the airfield lighting is commanded to another state.
3. **Loss of control operations by the CU:** Both redundant CU computers or their application are turned OFF but the ASP®-System circuits remain ON. In such case, the signalling on the series circuit from the SCM will cease due to lack of CU/SCM communications thereby forcing the LMS to assume their pre-programmed Failsafe state (the pre-programmed failsafe state matches that as would be commanded).

[1] Safegate has a set of general recommendation or preferences regarding for example cable routing, which may be applied in case a new series circuit is to be designed.

4. **Loss of SCM, SCF, or related component in series circuit interface OR SCM communications with the CU:** In such case, ASP® signalling on the series circuit will cease as a result of the hardware failure thereby forcing the LMS to assume their pre-programmed "Failsafe" state.

7 COMMUNICATION PRINCIPLES

The information exchange is performed according to the structure shown below in Figure 2.

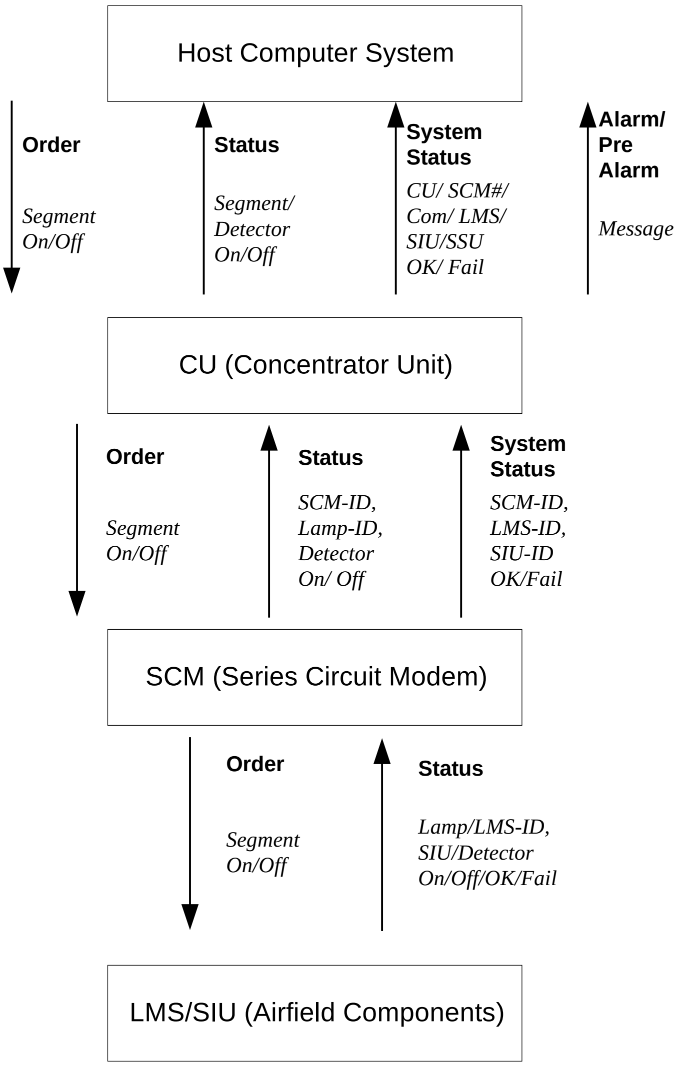

Figure 2 ASP-System information exchange.

The communication between the components at the different levels is such that the higher level device always polls the lower level device, evaluates the answers, and determines the on/off and pass/fail status for the functions or components

below. If a unit fails to report within a predetermined amount of time, it is assumed to be failed until reported otherwise.

The evaluation of conditions is performed at the lowest level possible and information condensed before transferred upward so as to minimize response times and transfer of information between each unit.

7.1 System Response Times

The ASP®-System is designed to provide up to date status information on individual lamps as well as light functions independently of the commanded lamp state, i.e. no matter if the lamp is commanded on or off. This implies that provided the system (and series circuit) is energized, status on lights and light functions is continuously available. The user of the system will not only be able to control desired light functions but will also know beforehand in what shape the system is in terms of operational readiness. Hence maintenance efforts may be launched as soon as any deficiencies are detected and well before the affected light functions are needed operationally.

The ASP®-System is designed to comply with operational requirements in terms of response times. In the chain of events including *air traffic controller reaction → system response time → physical changes in the field → pilot reaction*, the system response time constitutes a minor part.

Time critical functions like stop bar control have priority over less critical functions like for example runway edge light monitoring.

Response times are measured from the ASP®-System interface from the point in time when a command is received to the point in time when the corresponding status information (true fed back) is available. The only exception to the above is when a *SafeControl*-control system is host in which case the response time includes host processing and overhead as well. In this case the response time is equivalent to the system response time.

7.1.1 Stop Bar Response Time

Maximum stop bar response time from receiving a command to true back indication is 2 s, typically less than 1 s. Sensor detection is typically reported within 1 s. The stop bar response time applies to both interleaved and non-interleaved configurations.

7.1.2 Lamp Monitoring Response Time

A lamp failure is detected and reported within 5s regardless of system configuration.

7.1.3 Command Sequence Response Time

Maximum response time for any light function command from receiving the command to true back indication is 10 s. This applies *regardless* of the number of light segments involved. In case the light function only affects a few segments the maximum response time is considerably lower. For single segment response time in general refer to 7.1.1.

The consequence of the above is that in an ASP-system it is always possible to predict the maximum response time regardless of the system configuration.

8 APPENDICES

8.1 Elements Of Importance

Below some important general aspects of smart lights (ASP) worth considering are listed. The Safegate ASP-System complies with all requirements.

8.1.1 Field Equipment

Equipment installed in the field, i.e. typically in hand holes, cans or man holes, are referred to as field equipment. Examples of such equipment are the LMS and the SIU.

8.1.1.1 Power Consumption

Requirement:

The power consumption for a field unit shall be less than 10W for all operating conditions.

Argument:

Reduces or eliminates need for upgrading CCRs and isolation transformers due to increased power consumption when smart lights are added to an existing circuit.

8.1.1.2 Encapsulation

Requirement:

The field unit shall have insulating, non-conductive encapsulation.

Argument:

To avoid electrical hazard and increase personal safety.

Requirement:

The field unit shall be completely sealed.

Argument:

For protection against the effect of long periods of immersion (IP 68).

8.1.1.3 Sensor Interfacing

Requirement:

The field sensor interface unit shall be able to monitor/control external sensors, as well as work as power supply for sensor.

Argument:

To decrease the number of electronic devices in the field.

8.1.1.4 Communication Technique

Requirement:

The communication with field units shall be through signals superimposed on the series circuit.

Argument:

No extra communication cables or connectors are needed in the harsh environment out in the field, which minimizes maintenance and maximizes reliability. No special procedures are needed for repairing or replacing connectors and/or cables.

Requirement:

The communication shall not be dependent of a continuous primary cable screen

Argument:

The screen of the primary cable cannot be guaranteed to be continuous.

Requirement:

The communication with field units shall rely on a circuit modem at one end, inside the substation, and field units that individually and independently of each other communicate through the power cable with the circuit modem without any additional repeaters/amplifiers placed in the field.

Argument:

A failure of a single field unit must not affect the overall circuit communication. One failed field unit must not affect the availability of the system any worse than one failed lamp.

8.1.1.5 System Configuration

Requirement:

All lights or just a selected number of light fixtures on a circuit shall be able to be equipped with field units.

Argument:

Makes the system more flexible, for example if only lead-on lights on a taxiway-circuit needs to be controlled.

Requirement:

If any link in an ASP system or control system fails, the system shall automatically go to a predefined failsafe state. The predefined state (ON or OFF) shall be able to be individually programmed for the field units.

Argument:

For safety reasons.

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Requirement:

The field units shall be able to be individually programmed with a predefined power-up state, ON, OFF or last commanded state. The field unit shall be able to remember its last commanded state at power losses for up to 20 seconds.

Argument:

For safety reasons. The power-up state of the lamps must be well defined even if other parts of the system are down. The field unit must be able to remember its last commanded state at short power losses, for example when switching between mains power and generator-set power.

Requirement:

The field units shall use standard isolation transformers and standard connectors.

8.1.1.6 Functionality

Requirement:

The field units shall be able to withstand the same current levels as isolation transformers are required to, i.e. 7.1 A_{RMS} continuously and 8.2 A_{RMS} for max 1 second.

Argument:

In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems) the <u>maximum continuous current supported is 7.1 A_{RMS}</u>. Additionally the LMS is designed to withstand current transients in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors) implying 5% over current or 6.9 A_{RMS} for max 5 seconds (overruled by the 7.1 A_{RMS} requirement presented above) and <u>25% over current or 8.2 A_{RMS} for max 1 second</u>

Requirement:

The field units shall automatically detect a failed lamp. When the failed lamp is replaced the field unit shall automatically detect this as well and no additional procedure shall be required to make the system aware of that the lamp has been replaced.

Argument:

To guarantee maximum availability the system shall be able to handle low level functionality (such as failed lamp detection) automatically without user intervention. This way maintenance will be efficient and the users of the system can focus on the operational aspects of running the airport.

Requirement:

The field unit must be able to report ON/OFF/FLASH/FAIL state of the lamp, and FAIL state of the field unit.

Requirement:

The field unit must be able to command the lamp to ON/OFF/FLASH state. In addition to that, if lamp is commanded flashing, the system must be able to keep the flashing lamp synchronized according to FAA advisory circular 150/5340-28 requirements for Runway Guard Lights systems.

8.1.1.7 Flexibility

Requirement:

The field unit performance must not depend on the grounding scheme used for isolation transformers or light fixtures.

Argument:

The field unit must not compromise personal safety requirements or electrical code requirements and hence it shall support grounded isolation transformers or fixtures as well ungrounded ones.

Requirement:

The system shall support a feature that minimizes sudden load changes, experienced by the CCR, on the circuits. This feature shall not decrease system response times.

Argument:

A sudden increase in load due to switching ON a large number of lights on a circuit can make the CCR trip because of undercurrent. In the same way, a sudden decrease in load due to switching OFF a large number of lights on the circuit can make the CCR trip because of overcurrent. These mentioned discrepancies are not accepted from an operational point of view, and decreases the lifetime of the CCR, lamps and field units. Because the CCRs on the market show great differences in coping with sudden load changes, a feature like that must be completely independent of CCR type, regulating characteristics etc.

It shall not be acceptable to affect the CCR by external signals to solve the problem, it is for example possible to prepare the CCR before a sudden decrease in load by temporarily decrease the CCR output current, but this solution will give a observable light intensity change that cannot be acceptable from an operational point of view.

8.2 Vault Equipment

Equipment installed in a vault or a sub station is referred to as vault equipment. Examples of such equipment are the SCM, the SSU and the CU.

8.2.1.1 Installation

Requirement:

Any active equipment connected to the series circuit must connect to the secondary of a standard isolation transformer. Active equipment such as modems must not be connected to the primary.

Argument:

No single unit on a series circuit must in case of failure be allowed to jeopardize the integrity of the circuit itself. By always connecting active equipment such as modems, to the secondary of an isolation transformer the result of a failure will be no worse than a failed lamp in terms of series circuit integrity, i.e. the series circuit itself will not be affected, nor will the CCR.

Requirement:

High voltage equipment (connected to the primary) shall be physically separated from low voltage equipment (connected to the secondary of an isolation transformer).

Argument:

High voltage and low voltage maintenance procedures are different and each one, when carried out, affects the availability of the system in different ways. By separating high voltage and low voltage equipment physically, the impact on system availability as a consequence of maintenance efforts is minimized. For example, if a modem needs maintenance the circuit is not affected and the CCR may be operated without constraints.

8.3 System Response Times

The airfield light control system shall be built to meet the operative demands and needs regarding response times. This means that time critical functions like stop-bar functions shall be given priority to, unlike less time critical functions like pure monitoring of lights.

8.3.1.1 Single Command Response Time

The response time for a command to be executed, such as a stop-bar command shall be 1 second from that the controller pushes the button until the light is switched. The acknowledgement from that the stop-bar light is switched until this is indicated on the controllers screen shall be 1 second.

8.3.1.2 Sensor Response Time

The time to detect an activated incursion sensor shall be 1 second.

8.3.1.3 Failed Lamp Response Time

The response time for indication of a failed lamp shall be 5 seconds.

8.3.1.4 Multi Segment Response Time

Multi-segment state change response times should always be less than 5s (from the command is sent to all lights have switched) no matter the number of involved segments/lights. As an extreme all lights on a single circuits shall be able to change state on command independently of each other and regardless of the desired light pattern and the number of lights involved, in less than 5s. Multi-segment state change including true feedback shall be completed in less than 10s.

AMT Basic-Pro

User's Guide

Contents

1 Revision history ... 4
2 Scope ... 4
3 Application ... 4
4 Abbreviations ... 4
5 References ... 4
6 Introduction ... 5
6.1 Requirements ... 5
6.2 Installation ... 5
6.3 Different variants of AMT ... 5
6.3.1 AMT Basic ... 5
6.3.2 AMT Pro ... 5
7 The user interface ... 5
7.1 Login ... 5
7.2 Main window ... 6
7.2.1 To adjust the main window ... 6
7.2.1.1 Undock ... 7
7.2.1.2 Dock ... 7
7.2.1.3 Hide windows ... 8
7.2.1.4 Show window ... 8
7.2.1.5 Save Layout ... 8
7.2.1.6 Lock Layout ... 8
7.3 Communication settings ... 8
7.3.1 Monitoring ... 8
7.3.2 Control and Monitoring ... 8
7.4 System Configuration ... 9
7.4.1 The Configuration Tree ... 9
7.4.2 Search in the Configuration ... 9
7.5 Log window ... 10
7.6 Tools Window ... 10
7.6.1 LPU Manager ... 10
7.6.2 FCU Inspector ... 11
7.6.3 SCM Inspector ... 11
7.6.4 LPC I/O ... 12
7.6.5 Circuit Monitor ... 12
7.6.5.1 Advanced Logging ... 13
7.6.5.2 Review Logged data ... 14
7.6.6 Circuit Tuning ... 15
7.6.7 Self Hosted SCM ... 15
8 To use AMT ... 15
8.1 Maintain LMS/SIU/SLIQ ... 16
8.1.1 Programming and test procedure ... 16
8.1.1.1 Programming an LMS in Remote Control (Automatic) Mode ... 16
8.1.1.2 Programming a SIU in Remote Control (Automatic) Mode ... 17
8.1.1.3 Programming a SLIQ ... 18
8.1.1.4 Programming an LMS in Manual Mode ... 19
8.1.1.5 Programming a SIU in Manual Mode ... 20
8.1.2 Testing Functions ... 21
8.1.2.1 LMS Function Test ... 21
8.1.2.2 SIU Function Test ... 22
Remote Control Mode ... 22
Manual Mode ... 23
8.2 SCM MAINTENANCE ... 23
8.2.1 SCM Maintenance ... 23
8.2.1.1 Activating SCM Maintenance ... 23
8.2.1.2 SCM Maintenance Sequence ... 24

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8.2.1.3 Troubleshooting SCM Maintenance 24
8.2.2 Loading SCM Firmware 25
8.2.3 Advanced Maintenance 26
8.2.3.1 Loading SCM Configuration........ 26
8.2.3.2 Loading SCM parameters........ 27
8.3 CIRCUIT MAINTENANCE 28
8.4 Circuit Monitor 28
8.4.1 Monitoring Circuit Communication........ 28
8.4.1.1 Evaluation of monitored communication........ 31
8.4.2 Sending Commands 32
8.4.3 FCU Version Query........ 32
8.4.4 Menu Command Reference........ 32
8.4.5 Other Commands........ 33
9 Advanced functions 33
9.1 FCU Maintenance 33
9.1.1 User Interface........ 33
9.1.1.1 The Configuration Pane........ 34
9.1.1.2 The FCU Parameter Pane 34
9.2 Circuit Tuning 36
9.2.1 Why circuit tuning?........ 36
9.2.1.1 ASP system power cable communication 36
9.2.1.2 Circuit tuning principles........ 36
9.2.1.3 Frequency tuning 36
9.2.1.4 A word of caution 36
9.2.2 Frequency tuning by AMT........ 37
9.2.2.1 Hardware setup 37
9.2.2.2 AMT frequency tuning principles 37
9.2.2.3 Before starting AMT frequency tuning sequence 37
9.2.2.4 AMT frequency tuning sequence........ 37
10 Self Hosted SCM 44
10.1 Configuration functionality 45
10.2 Monitoring functionality........ 46
11 User handling 46
11.1 User groups 46
12 Appendix........ 47
12.1 LPU........ 47
12.1.1 Hardware setup for Manual Mode........ 47
12.1.2 Hardware setup for Remote Control Mode 47

1 REVISION HISTORY

Ver	Date	Remark	Author
1.0	2004-06-17	Translated tools windows information	JF
A	2004-10-07	Updated screen-shots and some LPU-prog texts Added chapter about evaluation of monitored signal levels	MH/JF
B	2005-07-05	Added description in DB Explorer about log window information. Updated window texts which have been changed.	SL
C	2005-12-02	Updated information in chapter 13.5.3.1 and 13.5.3.2.	SL
D	2010-02-25	Added instruction of how to program SLIQ using Production ID.	SL

2 SCOPE

This document describes the software *ASP Maintenance Tool* (AMT 591819), its functionalities and use.

3 APPLICATION

This document is intended for users that are well acquainted with the ASP-system. As AMT is created to simplify and increase efficiency at maintenance, commissioning and troubleshooting, the document is mainly for users that work with these activities.

Figures, function descriptions etc in this document is based on version 3.3 of AMT which implies that earlier versions not necessary work or look as described here. In those cases, consult the user manual for the earlier version.

4 ABBREVIATIONS

ASP	Airfield Smart Power
AMT	ASP Maintenance Tool
CCR	Constant Current Regulator
CU	Concentrator Unit
SCM	Series Circuit Modem
FCU	Field Communication Unit (LMS or SIU)
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
LPU	LMS/SIU Programming Unit (consists of an SCM and an LPC)
LPC	LPU Control Unit
SFU	Signal Filtering Unit

5 REFERENCES

SG591891-3001 AMT User's Guide[1]

[1] Describes earlier AMT versions, before 3.0

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6 INTRODUCTION

6.1 Requirements

Following are the operative systems that are supported by AMT:

- Windows 98
- Windows 2000 Professional
- Windows NT 4.0 Workstation
- Windows XP Professional

In addition to that, the computer that AMT is running on must have:

- Monitor resolution at least 800 × 600.
- **Serial Communication Port**
- Fontsize *small size* or 96 DPI. If other size is used, some of the windows in AMT can be distorted and/or impossible to read.

6.2 Installation

Run the installation program *setup.exe* from the CD that AMT is delivered with. That will install AMT on the hard disc and add a program group on the start menu, called Safegate.

6.3 Different variants of AMT

In principal, AMT comes in two versions. The difference between them is the number of tools included. Exactly what is included in each variant is determined by Safegate.

6.3.1 AMT Basic

The AMT Basic variant is intended for the user that only needs to program spare parts to an ASP system. That includes programming of LMS, SIU and SCM. Alternatively or as a complement, tools can be included for configuration and monitoring of stand-alone ASP system, so called Self Hosted SCM.

6.3.2 AMT Pro

The AMT Pro includes (in addition to what is supported by the Basic variant) also tools for commissioning, monitoring and troubleshooting of the ASP system and its components.

7 THE USER INTERFACE

This section describes the user interface, and briefly describes the functionality that the different tools provide.

7.1 Login

When AMT is started up, the user is asked to login with his username and password.

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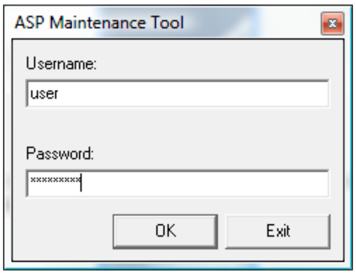
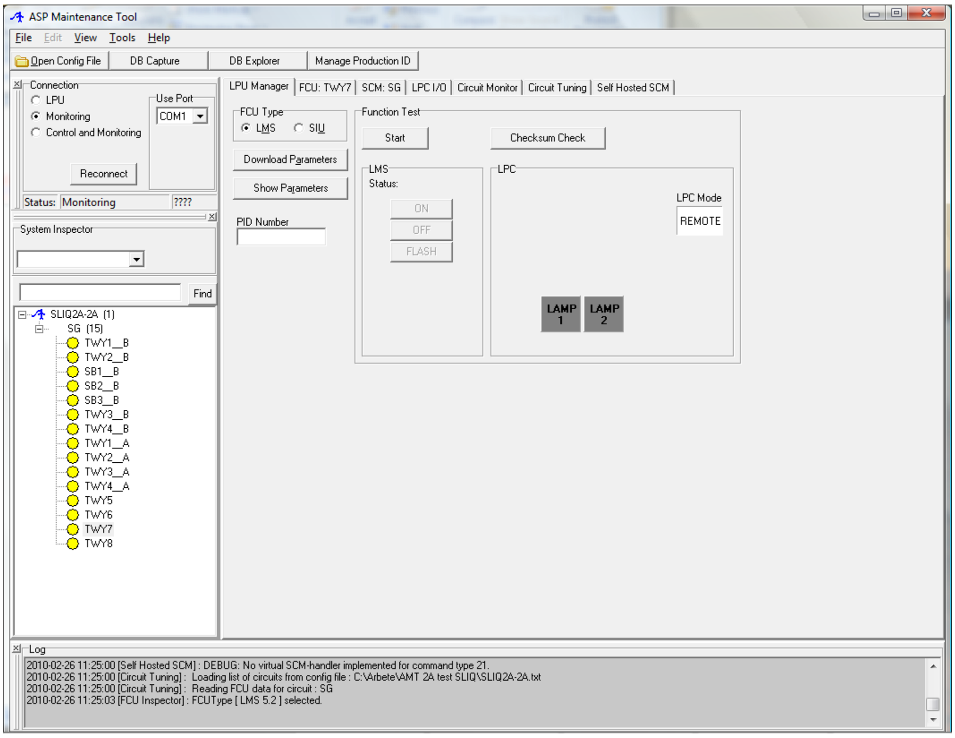


See section 13 for more information about the administration of users and user groups.

7.2 Main window

If the username and login is correct, the main window is shown.



The main window consists of three parts:

- To the left is a section for communication settings (*Connection Manager*) and system configuration (*System Inspector*)
- To the right is a section for different tools. Each tool has its own flap.
- Down at the bottom is a log window.

In the top of the main window is a menu with a number of shortcut buttons.

7.2.1 To adjust the main window

The user has some freedom to adjust the look of AMT. The user can choose:

- between the tools on the flaps and other functions integrated/docked in the main window *or* each of the tools in separate windows *or* a combination of the two
- which of the tools and other functions that will be visible

7.2.1.1 Undock

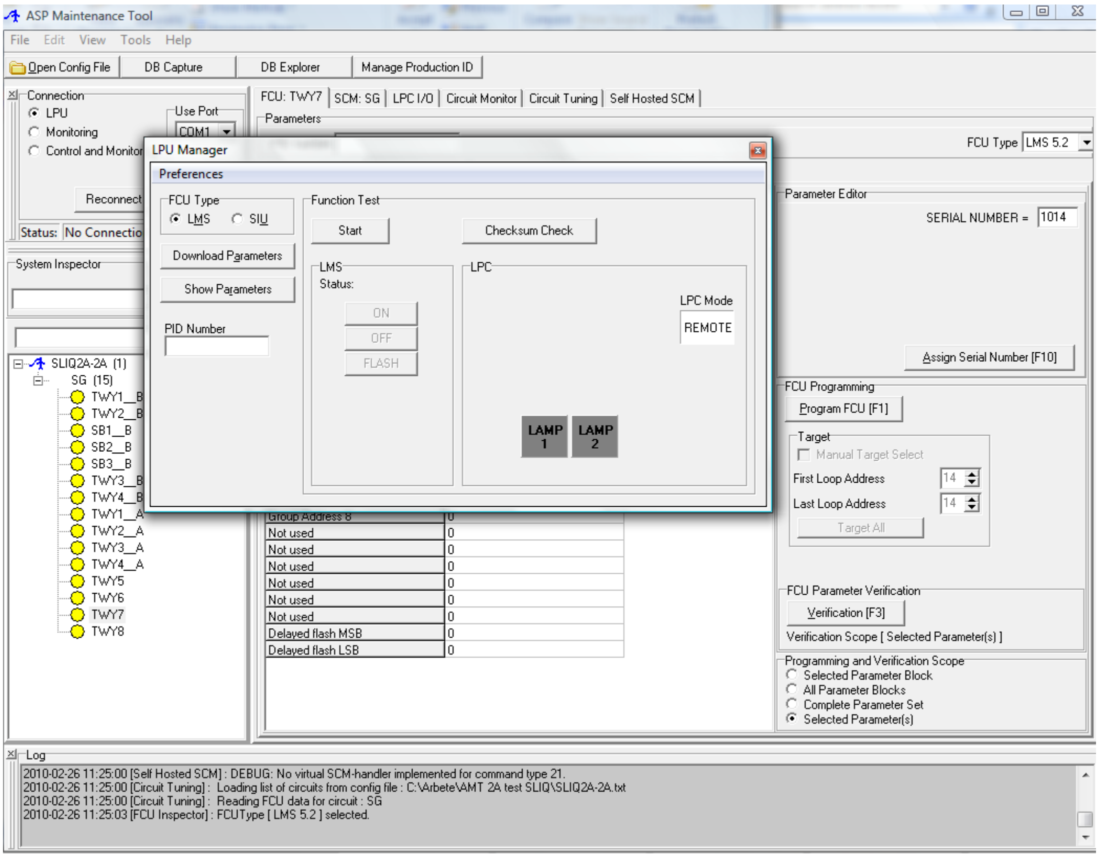
First check that the alternative *Lock layout* on the *View*-menu is deselected – not until then a tools window can be undocked.

To undock e.g. a tools window from its flap, double-click on the flap, then the tool will get its own window. Alternatively drag and drop with left mouse button. The undocked window will always remain on top of the main window, so to be able to reach the main window; the undocked window may have to be moved.

Note that if either both *Connection Manager* and *Inspector* or *Log*-window is undocked, the tools section will grow to the left and/or down.

7.2.1.2 Dock

To dock a tools window to the main window, grab the name list of the window and drag it to the upper right corner of the main window. A frame is shown in the main window. Drop the name list and the window is docked and gets its own flap.



If the *Log* window is intended to be docked, drag it to the bottom part of the main window. When both the *Connection Manager* and *System Inspector* is separate windows and one of them is supposed to be docked, it must be dragged to the left part of the main window.

Note that not all windows can be docked everywhere:

- The tools windows can only be docked to the right part of the mains window
- *Connection Manager* and *System Inspector* can be docked either to the right or to the left part of the mains window.
- The *Log* window can only be docked at the bottom part of the main window.

7.2.1.3 Hide windows

To hide a window, either click on the cross in the upper right or left corner or deselect the window in either the *View*- or *Tools*-menu.

7.2.1.4 Show window

To show a window, select the window in either the *View*- or *Tools*-menu.

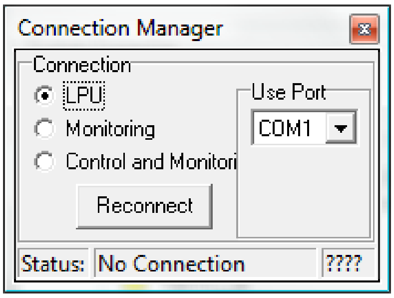
7.2.1.5 Save Layout

If *Save Layout* is selected in the *View*-menu, the program will start with the same layout as when it was shut down the last time before.

7.2.1.6 Lock Layout

By selecting *Lock Layout* in the *View*-menu, tools windows can neither be docked or undocked. This does not influence the possibilities to show or hide windows. Every time AMT is started, *Lock Layout* will be activated. If the user wants to change the layout, *Lock Layout* must first be deselected.

7.3 Communication settings



In order to get AMT to work correctly, there must be an active connection to a SCM. That is irrespective if AMT is connected to a LPU or an ASP system. Use *Connection manager* to specify what type of connection there is, and what COM-port is used on the computer. Is AMT connected to a LPU, select LPU. Is AMT connected to an ASP system, select either "Monitoring" or "Control and Monitoring". To activate all functionalities in AMT, AMT must be run in"Control and Monitoring"-mode.

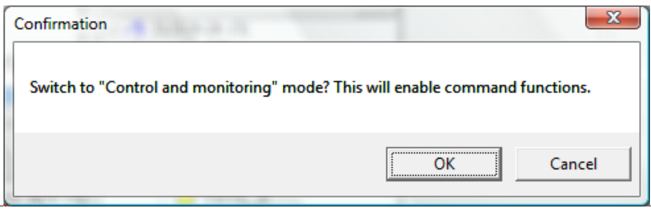
Actual state of the connection to the SCM is shown at the bottom of *Connection Manager*.

7.3.1 Monitoring

When AMT is connected to an ASP system "monitoring", meaning that the ASP system is operative, AMT is only listening to the operative communication (*Listen Mode*). To avoid interference with the operative communication, all commanding functionality in AMT are blocked in the "monitoring"-mode. Every time AMT is started, "Monitoring" mode is pre-selected, and the user must by himself select "Control and monitoring" mode.

WARNING! Note that the front switch on the SCM "RS485/RS232" (alt. "REMOTE/LOCAL") must remain in RS485 to avoid interference with an operative system. By setting the switch to RS232 (LOCAL), the SCM will be taken out of operative running.

7.3.2 Control and Monitoring

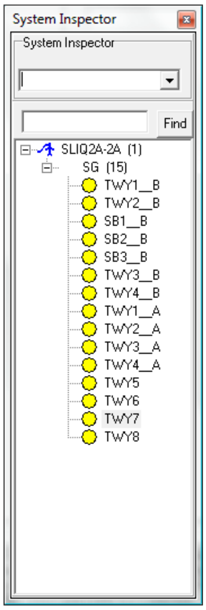


In opposite to "Monitoring", "Control and Monitoring" means that AMT have exclusive access to the part of the system that is controlled by the SCM.

When"Control and Monitoring" is selected, there are no functional restrictions comparing to the "Monitoring" mode. Every time the user is changing from "Monitoring to "Control and monitoring", a dialogue window appears that asks the user to acknowledge before the change is made, to secure that "Control and monitoring" mode is not selected by mistake.

7.4 System Configuration

A system configuration contains information about the different components in the system, mainly LMS and SIU. Many of the tools in AMT need access to a system configuration to be able to work correctly. *System Inspector* is used to load the system configuration, to navigate in it and in some cases to manipulate it.



The window is consisting of two parts:

- At the top is a search field.
- At the bottom is a tree structure where the configuration is shown.

7.4.1 The Configuration Tree

The content of the configuration is shown in a tree structure where the uppermost level symbolises the site. Below that level is the different circuits, and on the bottom level is the lamps and sensors. By selecting a lamp or sensor in the tree, it will automatically be active and available by all tools in AMT.

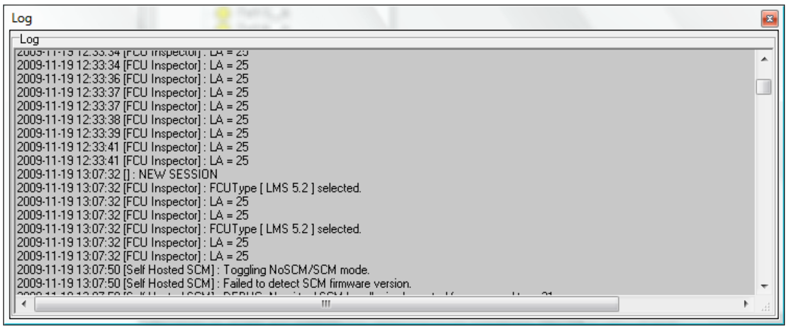
To the left of every lamp and sensor, there is an icon that symbolises the object. If the user clicks with the right mouse button on an active lamp or sensor, a small menu turns up where a number of selections are available:

- *Collapse All*: Compress the tree so that only the uppermost level is visible.
- *Expand All*: Expands the tree so that all levels are visible.
- *Auto Expand*: If this function is active, all circuits will be compressed except the selected circuit.
- *Clear Status*: Resets the status indication that is shown to the left of the symbols for the object (lamp or sensor).

7.4.2 Search in the Configuration

Write the complete or beginning part of the name in the search field and press enter. The first occurrence of the text string is shown by highlighting the object in the configuration tree.

7.5 Log window



The log window is used to show events that either is initiated by the user or is a result of an action made in a tools window. All events are time stamped and the log is accumulative, which means that every time AMT is started, the log from the preceding session is opened and continued. Thereby, the log will be a user's history for AMT on a specific computer.

7.6 Tools Window

The tools in AMT are gathered in different tools windows. The type of tool and its use is determining which tools window it belongs to. Some tools are available from several windows.

Tool windows available in AMT are:

- LPU Manager
- FCU Inspector
- SCM Inspector
- LPC I/O
- Circuit Monitor
- Circuit Tuning
- Self Hosted SCM

7.6.1 LPU Manager

The *LPU Manager* tool window is only used when AMT is connected to a LPU. The purpose of the window is to provide the user functionality for programming, verifying and test of LMS and SIU. The functions in this window are only available when the LPU connection in *Connection Manager* is selected.

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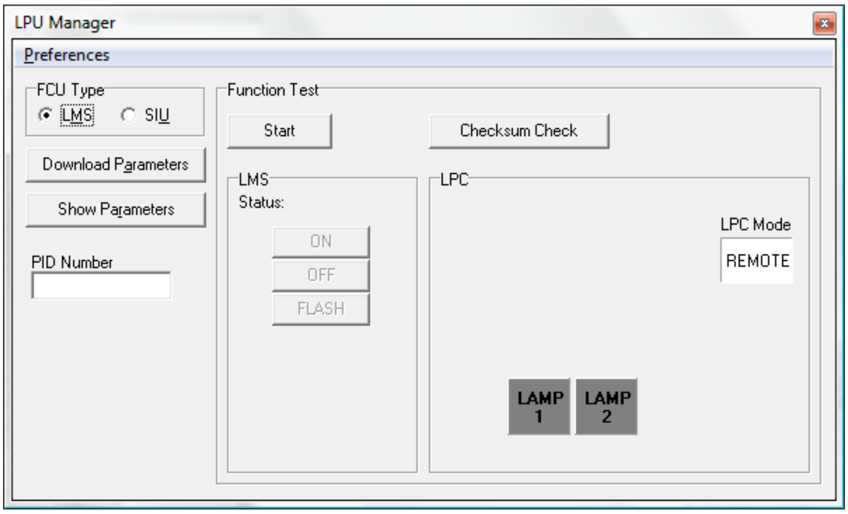


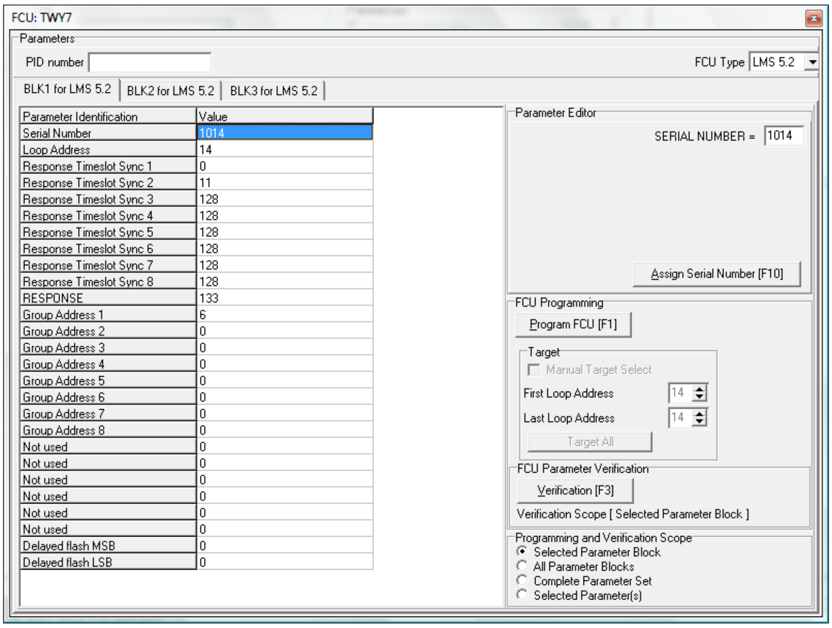
LPU Manager can remotely control the LPU for automatic handling of the programming- and verifying sequences.

FCU Type allows the user to select the type of FCU (Field Communication Unit) to be programmed.

The button *Download Parameters* will start the programming sequence.

7.6.2 FCU Inspector

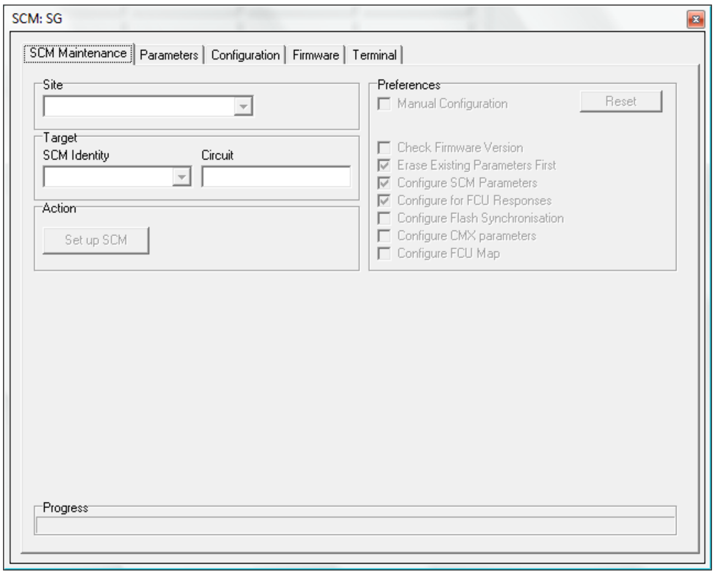
In the case the parameters of an individual LMS or SIU need to be reviewed, edited or verified, the *FCU Inspector* provides access to every parameter and a couple of advanced programming- and verifying tools.



7.6.3 SCM Inspector

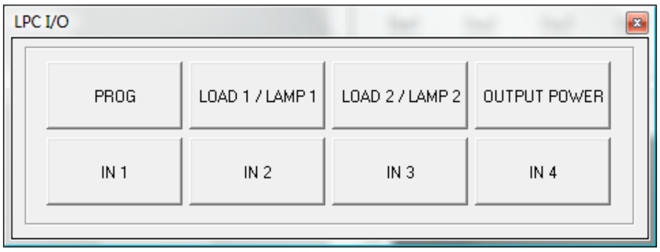
SCM Inspector provides access to individual SCM-parameters and functionality for down- and uploading of these parameters.

As an addition, there is functionality for downloading of SCM firmware.



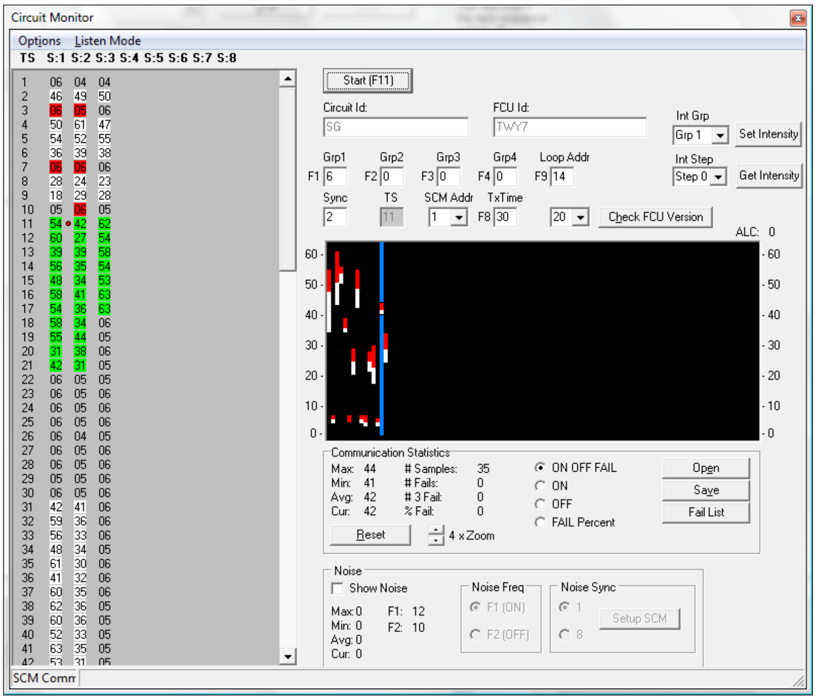
7.6.4 LPC I/O

The *LPC I/O* window provides direct control of certain buttons on the LPC provided. This is mainly for test purpose.



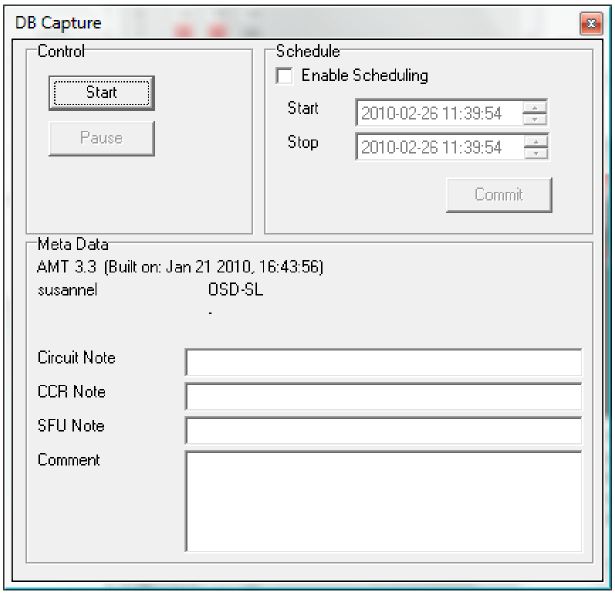
7.6.5 Circuit Monitor

One of the most versatile and useful tools is *Circuit Monitor*. This tool provides monitoring as well as control of all units on the series circuit to which AMT is connected. The tool provides graphic presentation of signal- and noise levels, statistics and an advanced log function.



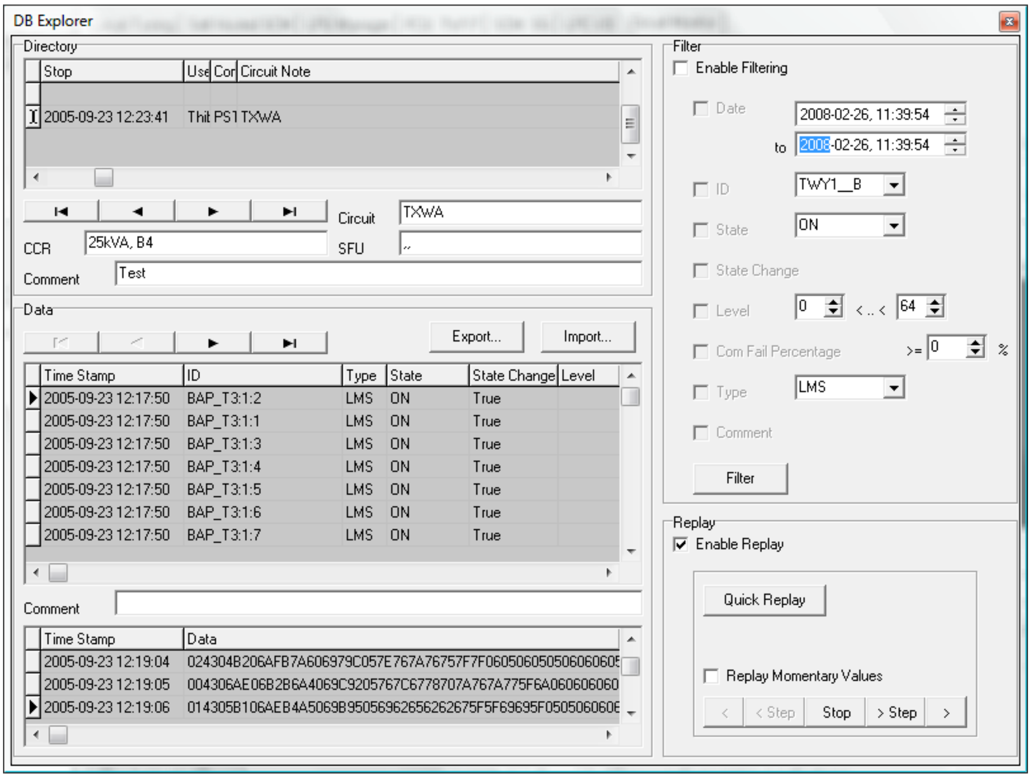
7.6.5.1 Advanced Logging

Data can be logged in a database for later evaluation. That includes raw data as well as status on system level. The logging can be initiated either manually or be programmed to start/stop at a specific time. Every logging sequence is time stamped with start- and stop time. Information about who has initiated the log as well as information about what AMT-version and computer have been used is also saved. The user must also state some *Meta Data* concerning the series circuit, CCR, filter units etc. If the user wants to, the log can be restricted to only include status changes for the system components. That is an advantage when long logging sequences are carried out, as the amount of logged data will be less extensive.



7.6.5.2 Review Logged data

By using the *DB Explorer*, the user can easily navigate to a specific logging sequence to be able to evaluate it. Uppermost in *DB Explorer* is a list of carried out logging sequences sorted by date. By selecting a sequence in *Directory*, supplementary details can be added in the *Meta Data* fields, CCR, SFU and other.



When a specific logging sequence is selected in *Directory*, *Data* will show high level information from the selected circuit, as well as raw data. Every event is individually time stamped. Comments can be added to any event.

The *Data* window includes the following information:

Time Stamp:	Time stamp identifies when data in displayed record was captured.
ID:	FCU ID
Type:	LMS/SIU
State:	Indicates lamp state for LMS and detection state for SIU
State Change:	State change identified with reference to previous record
Level:	Signal level
Com Fail:	Number of communication failures
Com Count:	Number of communication repetitions
Start:	Indicates when capture was stared for data to which the displayed record belongs
Comment:	User Comment

To the right in *DB Explorer* there are functions for filtering. Filtering can be based on:

- Date and time

- System ID
- State
- State change
- Signal level
- Communication fail percentage
- System component type
- Comment

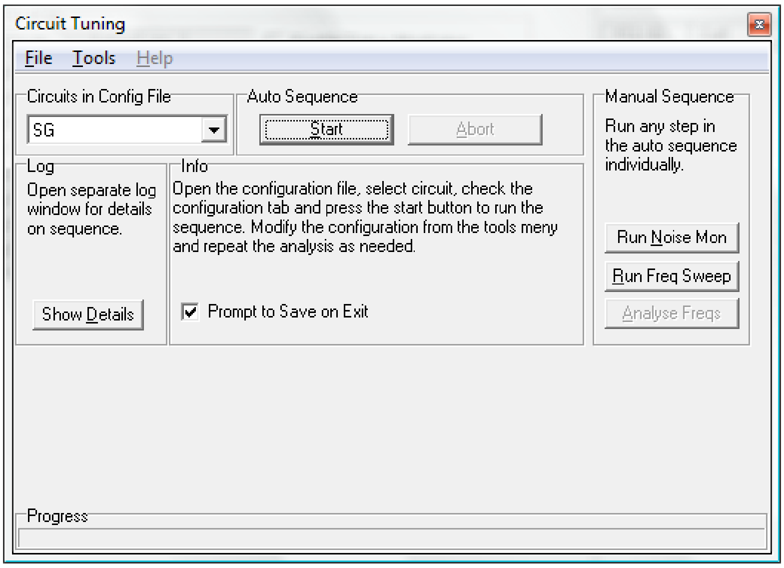
Filtering can also be based on a combination of the above, and then only events that fulfil all selected criteria will be shown.

A filtered log can be exported to a separate database that can be sent by email or equivalent. Similarly, data can be imported to an existing database. This data will then be chronologically sorted in relation to the existing data in the database.

Selected log sequence can also be replayed in *Circuit Monitor* to get a graphical view of the communication.

7.6.6 Circuit Tuning

Circuit Tuning is a process that is used at commissioning of ASP system, the *Circuit Tuning* tool provides fully automatic functions for that purpose.



7.6.7 Self Hosted SCM

Some types of ASP system can be configured without a NCU. In those cases, the SCM will handle many of the functionalities that are normally handled by the NCU. The *Self Hosted SCM* tool includes functionality to configure the SCM as well as monitor the resulting system functionality.

8 TO USE AMT

This section describes a number of common tasks, and how to solve them with use of AMT and its functionalities.

8.1 Maintain LMS/SIU/SLIQ

To maintain LMS/SIU/SLIQ is mainly to program spare parts, modify parameters and test suspected malfunctioning units.

The following applies only when using the LPU version consisting of an LPC and an SCM interconnected, for programming LMS:es, SIU:s, SLIQ:s and maintaining SCM’s.

Designations for the switches corresponds to SCM 591813B and LPC version 3. Appendix A shows a layout of the different versions of the SCM and LPC.

New Designation	**Old designation**
SCM RS485/RS232	Remote/Local
LPC Remote	Remote/Local
LPC LAMP 1	LOAD 1/LAMP 1
LPC LAMP 2	LOAD 2/LAMP 2

8.1.1 Programming and test procedure

8.1.1.1 Programming an LMS in Remote Control (Automatic) Mode

If you need to program a large number of LMS:s, then the Remote Control Mode will help you to simplify and speed up the process. In this mode the AMT software will automatically turn the LPC switches on/off, etc. Connect the hardware as described in section 14.1.2 Hardware setup for Remote Control Mode. In the ***Settings*** menu you also need to activate the ***Remote Control LPC*** item.

1. At the programming screen you first need to select the correct configuration in the System panel.
2. Multiple choices for ***FCU Type*** are available. Select ***LMS***.
3. Release the **LAMP 1** or **LAMP 2** buttons on the LPC if any of these buttons is pressed in.
4. Connect the LMS male connector to an **OUTPUT** outlet on the LPC.
5. Connect the LMS female connector to an **LMS** outlet on the LPC.
6. You also need to identify the individual LMS you intend to program. You do this by either writing the id in the ***Find*** field to search for it or select the id in the System panel list.
7. Press the ***Download Parameters*** button to start the programming sequence.
8. A message box allows you to click on the ***Cancel*** button to stop the download sequence if you would like to do so. If you want to continue the download sequence, click on the ***Continue*** button, see Figure 1.

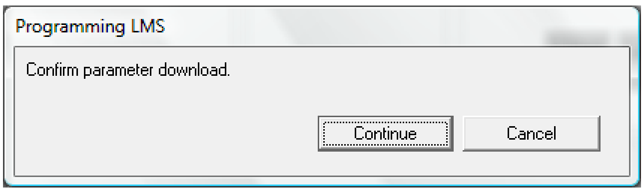


Figure 1. *Confirm parameter download.*

9. A hardware initialisation is started only if the option ***Skip Version Control*** is deselected. The LMS version is identified and the optimal parameters for communication with the LMS are set. When the LMS version dialog box is displayed you click the ***OK*** button to start the parameter download sequence.

   If the ***Skip Version Control*** is active then no version control is performed.
10. After downloading the parameters, which can take up to a minute a checksum check will be done to ensure that the LMS has received the new parameters. If the checksum is correct a message box is shown to confirm this.
11. If the checksum is OK the LMS may be disconnected. To program another LMS repeat this procedure from step 4 above. However, if a message box tells you that the checksum is incorrect then you need to reprogram the same LMS unit from step 7 above.

8.1.1.2 Programming a SIU in Remote Control (Automatic) Mode

If you need to program a large number of SIU:s, then the Remote Control Mode will help you to simplify and speed up the process. In this mode the AMT software will automatically turn the LPC switches on/off, etc. Connect the hardware as described in section 14.1.2 Hardware setup for Remote Control Mode. In the ***Settings*** menu you also need to activate the ***Remote Control LPC***.

1. At the programming screen you first need to select the correct configuration in the System panel.
2. Multiple choices for ***FCU Type*** are available. Select ***SIU***.
3. All **IN** and **OUT** buttons as well as **LAMP 1** and **LAMP 2** on the LPC should be released.
4. Connect the SIU male connector to an **OUTPUT** outlet on the LPC.
5. Connect the SIU sensor interface connector to the **SIU** outlet on the LPC.
6. You also need to identify the individual SIU you intend to program. You do this by either writing the id in the ***Find*** field to search for it or select the id in the System panel list.
7. Press the ***Download Parameters*** button to start the programming sequence.
8. A message box allows you to click on the ***Cancel*** button to stop the download sequence if you would like to do so. If you want to continue the download sequence, click on the ***Continue*** button, see Figure 2.

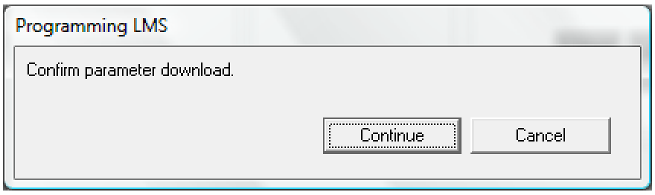


Figure 2. *Confirm parameter download.*

9. A hardware initialisation is started only if the option ***Skip Version Control*** is deselected. The SIU version is identified and the optimal parameters for communication with the SIU are set. When the SIU version dialog box is displayed you click the ***OK*** button to start the parameter download sequence.

   If the ***Skip Version Control*** is active then no version control is performed.

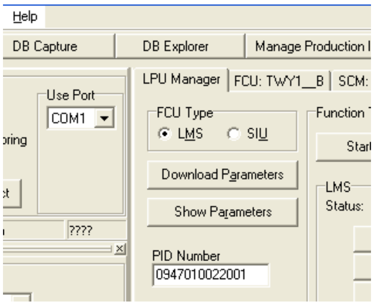
10. After downloading the parameters, which can take up to a minute a checksum check will be done to ensure that the SIU has received the new parameters. If the checksum is correct a message box is shown to confirm this.

11. If the checksum is OK the SIU may be disconnected. To program another SIU repeat this procedure from step 4 above. However, if a message box tells you that the checksum is incorrect then you need to reprogram the same SIU unit from step 7 above.

8.1.1.3 Programming a SLIQ

The programming of parameters is done in the LPU Manager window in AMT.

1. Make sure the Remote button on the LPC is not pressed (off) before you start programming.
2. Connect the LMS male connector to an **OUTPUT** outlet on the LPC.
3. From the configuration list select the correct light parameter name to configure.
   Note: The product may require configurations of both sides or only one side. Parameter name __A is for A-side and __B is for B-side of SafeLED IQ.
4. Check the bottom of the SafeLED IQ for Production ID (PID) number.
5. Enter the PID Number in the text field



6. Press the ***Download Parameters*** button to start the programming sequence.
7. Click ***Continue*** to confirm parameter download, see Figure 3.

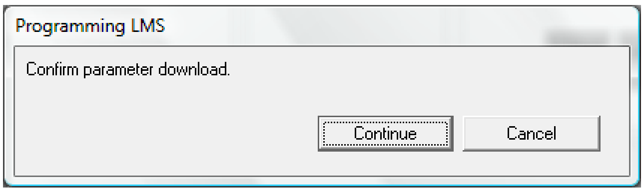


Figure 3. *Confirm parameter download.*

8. After downloading the parameters, which can take up to a minute a checksum check will be done to ensure that the SLIQ has received the new parameters. If the checksum is correct a message box is shown to confirm this, see Figure 4 above.
9. If the checksum is OK the LMS may be disconnected. To program another LMS repeat this procedure from step 4 above. However, if a message box tells you that the checksum is incorrect then you need to reprogram the same LMS unit from step 7 above.

8.1.1.4 Programming an LMS in Manual Mode

1. At the programming screen you first need to select the correct configuration in the System panel.
2. Multiple choices for ***FCU Type*** are available. Select ***LMS***.
3. Connect the LMS male connector to an **OUTPUT** outlet on the LPC.
4. Connect the LMS female connector to an **LMS** outlet on the LPC.
5. You also need to identify the individual LMS you intend to program. You do this by either writing the id in the ***Find*** field to search for it or select the id in the System panel list.
6. Press the ***Download Parameters*** button to start the programming sequence.
7. A message box is shown to remind the user to turn on the **OUTPUT POWER** on the LPC, see Figure 3.

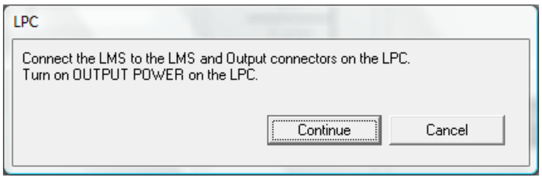


Figure 4. *Turn on OUTPUT POWER switch.*

8. Follow the instructions on the screen for controlling the **LAMP** switch on the LPC, see Figure 4.

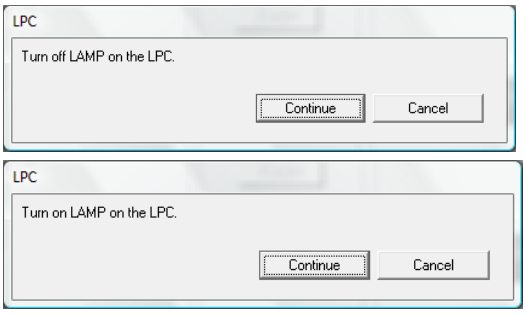


Figure 5. *Instructions for controlling the LAMP switch.*

9. A hardware initialisation is started only if the option ***Skip Version Control*** is deselected. The LMS version is identified and the optimal parameters for communication with the LMS are set. When the LMS version dialog box is displayed you click the ***OK*** button to start the parameter download sequence, see Figure 5.

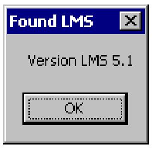


Figure 6. *Found LMS*

If the ***Skip Version Control*** is active then no version control is performed.

10. After downloading the parameters, which can take up to a minute a checksum check will be done to ensure that the LMS has received the new parameters. If the checksum is correct a message box is shown to confirm this, see Figure 6.

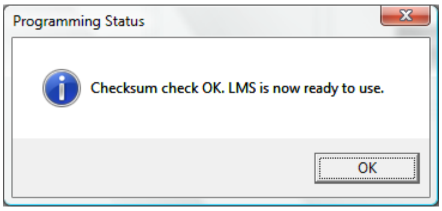


Figure 7. *Checksum OK*

11. If the checksum is OK the LMS may be disconnected. To program another LMS repeat this procedure from step 3 above. However, if a message box tells you that the checksum is incorrect then you need to reprogram the same LMS unit from step 6 above.

8.1.1.5 Programming a SIU in Manual Mode

1. At the programming screen you first need to select the correct configuration in the System panel.
2. Multiple choices for ***FCU Type*** are available. Select ***SIU***.
3. All **IN** and **OUT** buttons as well as **LAMP 1** and **LAMP 2** on the LPC should be released.
4. Connect the SIU male connector to an **OUTPUT** outlet on the LPC.
5. Connect the SIU sensor interface connector to the **SIU** outlet on the LPC.
6. You also need to identify the individual SIU you intend to program. You do this by either writing the id in the ***Find*** field to search for it or select the id in the System panel list.
7. Press the ***Download Parameters*** button to start the programming sequence.
8. A message box is shown to remind the user to turn on the **OUTPUT POWER** on the LPC, see Figure 7.

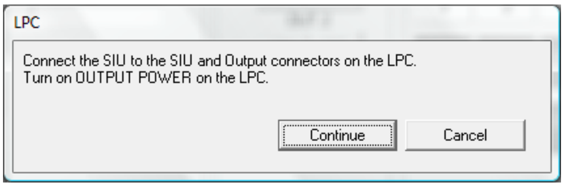


Figure 8. *Turn on OUTPUT POWER switch.*

9. Follow the instructions on the screen for controlling the **PROG** switch on the LPC, see Figure 8.

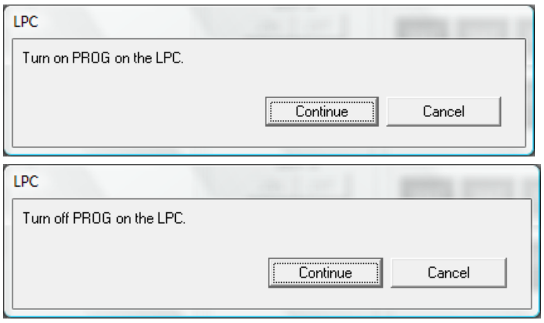


Figure 9. *Instructions for controlling the PROG switch.*

10. A hardware initialisation is started only if the option ***Skip Version Control*** is deselected. The SIU version is identified and the optimal parameters for

communication with the SIU are set. When the SIU version dialog box is displayed you click the ***OK*** button to start the parameter download sequence, see Figure 9.

Figure 10. *Found SIU*

If the ***Skip Version Control*** is active then no version control is performed.

11. After downloading the parameters, which can take up to a minute a checksum check will be done to ensure that the SIU has received the new parameters. If the checksum is correct a message box is shown to confirm this, see Figure 10.

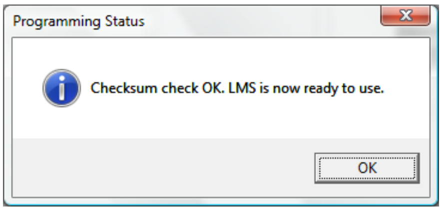


Figure 11. *Checksum OK.*

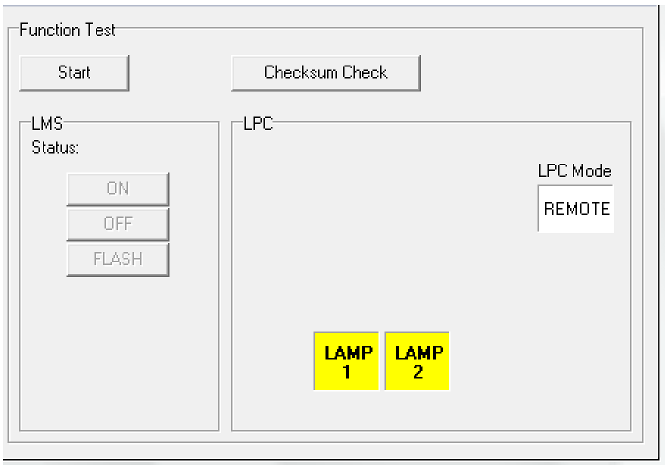
12. If the checksum is OK the SIU may be disconnected. To program another SIU repeat this procedure from step 4 above. However, if a message box tells you that the checksum is incorrect then you need to reprogram the same SIU unit from step 7 above.

8.1.2 Testing Functions

If ***Remote Control Mode*** is used the three test functions described below will automatically operate the switches on the LPC. If however ***Manual Mode*** is used the user have to manually operate the **OUTPUT POWER** switch on the LPC.

The ***Remote*** button can also be used to set if ***Remote Control Mode*** should be used or not. Note that the **Remote** switch on the LPC must be set to the same position.

8.1.2.1 LMS Function Test

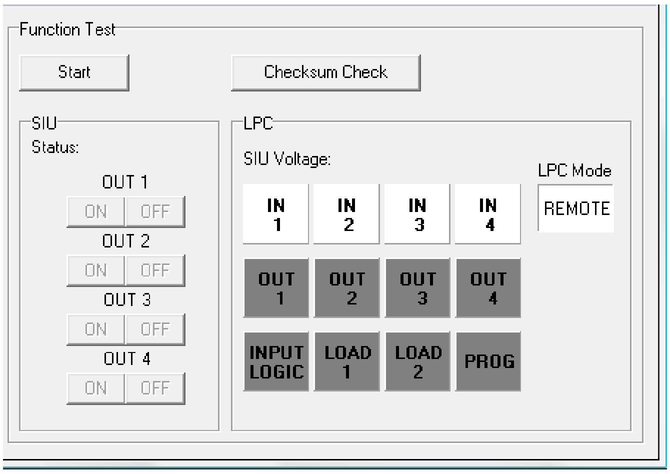


First choose the correct FCU Id in the list. Then press ***Start*** to start the communication with the LMS. The status returned from the LMS is shown to the right of ***Status***. There is three different states: ON (also implies to FLASH), OFF and LAMP FAIL (also implies to com. Error).

The LMS can be controlled by using any of the three command buttons: ON, OFF and FLASH.

If ***Remote Control Mode*** is activated you can click on the ***LAMP 1 / 2*** buttons to disconnect the lamp. The LMS should then report LAMP FAIL. If ***Remote Control Mode*** is not activated the user must manually control the **LAMP 1 / 2** buttons on the LPC.

8.1.2.2 SIU Function Test



First choose the correct FCU Id in the list. Then press ***Start*** to start the communication with the SIU. The status returned from the SIU is shown to the right of ***Status***. There are three different states: Detect, No Detect and Com. Error.

There are eight buttons for controlling the four outputs on and off (OUT 1 to OUT 4). Only the outputs that are controllable in the SIU parameters are enabled.

Remote Control Mode

SIU Voltage shows the SIU output voltage. For a more accurate reading use the multimeter connection on the LPC.

IN 1 to ***IN 4*** control the SIU inputs on the LPC. The color of the text in the buttons states what status the SIU is reporting for that particular input:

Black font	: Waiting for report from SIU.
Green font	: The SIU reports with the same status as the current input.
Red font	: The SIU reports with incorrect status.

INPUT LOGIC has the same function as the corresponding switch on the LPC. That is to choose if the buttons **IN 1** to **IN 4** should be lit or not when the button is pressed in.

LOAD 1 and ***LOAD 2*** is used for loading the SIU voltage output. The voltage shown to the right of ***SIU Voltage*** may drop slightly if any of the loads are activated. The load will automatically be turned off after about 10 seconds.

PROG has currently no function in ***Remote Control Mode***.

Manual Mode

IN 1 to ***IN 4*** shows the SIU reported status for that particular input. The answer is coded in three different colors:

Green font	: The SIU reports that the current input is on.
Organge font	: The SIU reports that the current input is off.
Red font	: The SIU does not answer.

8.2 SCM MAINTENANCE

8.2.1 SCM Maintenance

The term *SCM Maintenance* refers, in this document, to the process of replacing an SCM-board or an entire SCM unit and thereto-related configuration.

An SCM-board or an SCM unit is configured, through software, in accordance with the requirements set by the individual ASP-system in terms of functionality and performance. This implies that if an SCM-board or an SCM unit is replaced the new board/unit will have to get a configuration matching that of the replaced board/unit for correct function in the system.

The configuration process consists of a few steps (of which two are described in section 8.2.3.1 and 8.2.3.2), all possible to perform independently and/or manually if needed. To facilitate the configuration process AMT supports an automatic configuration process where the user only has to specify which SCM to configure.

8.2.1.1 Activating SCM Maintenance

For correct operation make sure that the SCM about to be configured is connected to the PC running AMT before *SCM Maintenance* is activated. When the SCM is connected, check that it's powered on and confirm the position of the switch marked RS232/RS485[2] to be RS232. Activate SCM Maintenance from within AMT by selecting *SCM Configuration* from the menu or press *F1*.

[2] Earlier versions of the SCM-board have the switch marked Local/Remote, which corresponds to RS232/RS485.

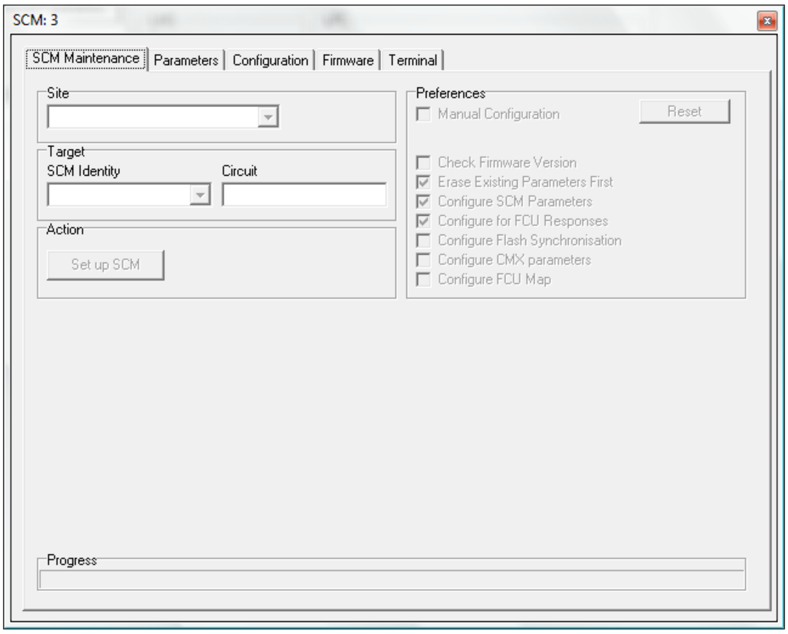


Figure 12. *SCM Maintenance view from AMT.*

Figure 13 shows the SCM Maintenance display and it's divided into three separate areas.The top left portion contains the *Site*, *Target* and *Action* panels. Here the user selects site and SCM-target units to specify which SCM to configure. The button *Set Up SCM* starts the configuration process.

To the right the *Preferences* area contains a range of options for customizing the configuration process. Normally the check box labeled *Manual Configuration* is unchecked. Note that depending on how AMT is configured the *Manual Configuration* option may not be available at all in which case the panel is empty.

The last area at the bottom is devoted to *Status* information in the form of a log file window. The log file will show all user actions as well configuration process status and error messages. Note that the log file is saved every time AMT is terminated and hence it shows *SCM Maintenance* history in addition to current activities.

Right below the Status information window a progress indicator is located.

8.2.1.2 SCM Maintenance Sequence

Provided that AMT is communicating with the SCM-board about to be configured the process consists of three simple steps:

1. Select site and SCM from the combo boxes labeled *Site* and *Target*. When an SCM is selected the circuit to which it's associated is shown to the right of the *Target* combo box.
2. Start the configuration process by pressing the *Set Up SCM* button. The configuration will normally take between two and ten second to complete.
3. Verify the proper completion of the configuration process by observing the messages displayed in the *Status* window.

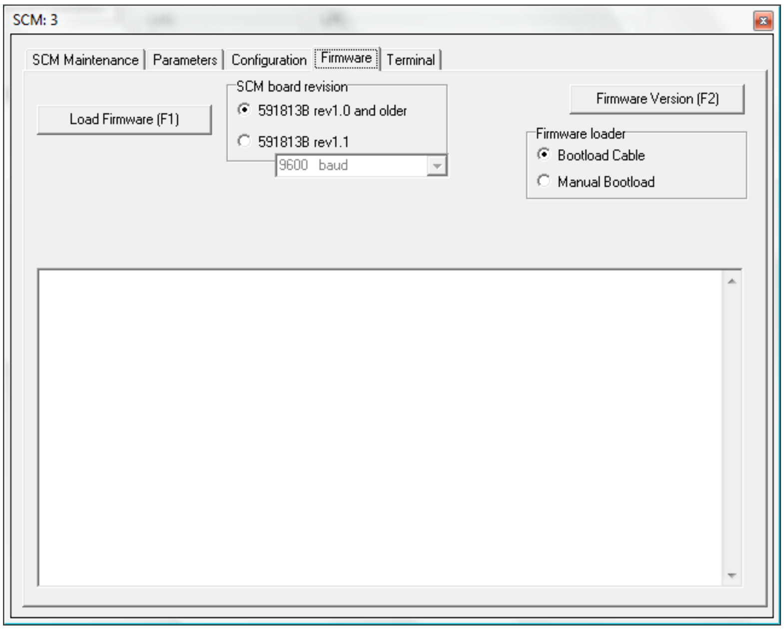
8.2.1.3 Troubleshooting SCM Maintenance

The SCM Maintenance feature in AMT relies on the existence of an INI-file, which contains the site specifics of the configuration process. Secondly all individual SCM configuration files for the particular site(s) must be available to AMT. Both the INI-file

and the SCM configuration files are normally included in the AMT-distribution for a particular site.

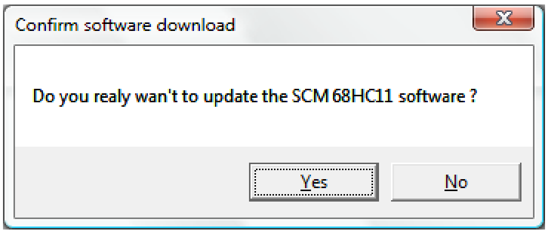
If any of these files are missing or if there is any other kind of problem the Status window will display detailed information about the problem. To solve the problem please contact Safegate support for assistance.

8.2.2 Loading SCM Firmware

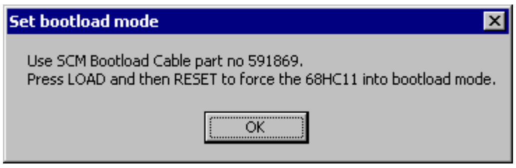


- **Load Firmware** starts loading of software to the SCM.
- **Firmware Loader** sets the way the SCM is set to firmware loading mode. The option bootload cable (bootload cable with LOAD/RESET switch) should always be used.
- **Firmware Version** shows the software version of the currently loaded firmware in the SCM.
- **Cancel** cancels a firmware download.

1. To load firmware to an SCM a Bootload Cable (part no 591869) is needed.
2. Make sure ***Firmware Loader*** is set to ***Bootload Cable.***
3. Press ***Load Firmware*** and select the correct firmware file with the filename format "*.A07".
4. A message box is shown to confirm loading of new firmware.



5. Press **LOAD** (the red LED should be lit) and **RESET** on the bootload cable black box to start software download. The download may take up to 10 minutes to finish.



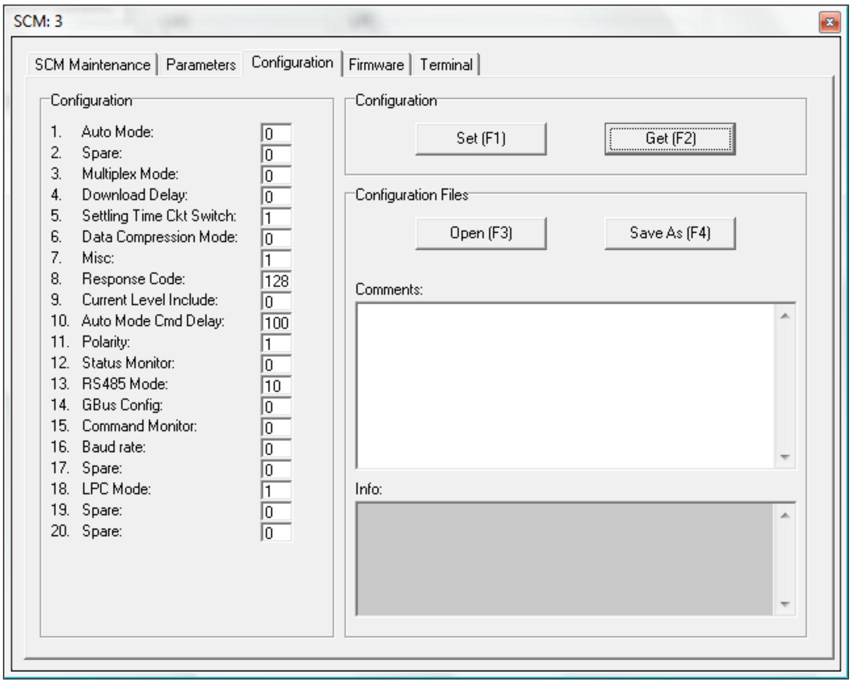
6. **Firmware installation completed successfully** will be shown in the message box if the operation was successful.

7. Press **LOAD** (the red LED should not be lit) and **RESET** on the bootload cable black box to restart the SCM.
8. To make the SCM functional, SCM parameters must be loaded, see chapter 13.5.1

8.2.3 Advanced Maintenance

The following chapters describe the manual loading of parameters to the SCM. These functions should only be used if the user has the right knowledge and has been educated for this purpose.

8.2.3.1 Loading SCM Configuration



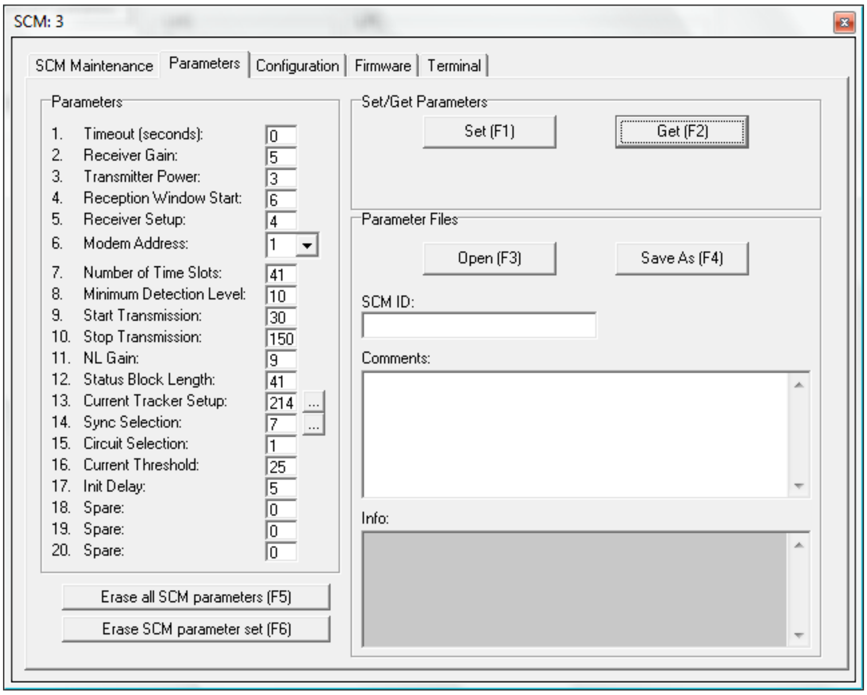
- **Set** sends the SCM configuration currently shown on the screen to the SCM.
- **Get** receives the configuration from the SCM and shows it on the screen.
- **Open** opens an SCM configuration file and shows it on the screen.
- **Save** saves the currently shown configuration on the screen to a file.

- In the field **Comments** general information can be added and saved with the configuration file.
- The field **Info** shows information from the last time the configuration file was saved.

1. Press **Open** to select the SCM configuration file (file extension CFG).
2. Press **Set** to send the configuration file to the SCM.

<u>**NOTE:**</u> If the SCM configuration settings are changed remember to save the new settings.
Save the old settings to a changed name file and the new settings to the existing file name. It is important to save the new settings to the same filename as before if the SCM maintenance should work as intended. Otherwise the SCM configuration file will NOT be read automatically when using SCM maintenance function.

8.2.3.2 Loading SCM parameters



- **Set** sends the parameters currently shown on the screen to the SCM.
- **Get** receives parameters from the SCM and shows them on the screen.
- **Open** opens an SCM parameter file and show the parameters on the screen.
- **Save** saves the currently shown parameters on the screen to a file.
- **Erase all SCM parameters** erases the parameter sets for all modem addresses in the SCM.
- **Erase SCM parameter set** erases the parameter set for the SCM address specified in the Unit Number field.
- In the field **SCM ID** a description of the SCM be added and saved with the parameter file.

- In the field **Comments** general information can be added and saved with the parameter file.
- The field **Info** shows information from the last time the parameter file was saved.

1. Press **Open** to select the SCM parameter file (file extension SCM).
2. Press **Set** to send the parameter file to the SCM.

NOTE: If the SCM parameter settings are changed remember to save the new settings.

Save the old settings to a changed name file and the new settings to the existing file name. It is important to save the new settings to the same filename as before if the SCM maintenance should work as intended. Otherwise the SCM parameter file will NOT be read automatically when using SCM maintenance function.

8.3 CIRCUIT MAINTENANCE

The term *Circuit Maintenance* refers to circuit monitoring and circuit tuning.

Circuit tuning is the process tuning the communication between the field- and the vault-units, i.e. the LMSs, SIUs and the SCMs, in an ASP-system.

Circuit monitoring includes low level ASP-system performance monitoring.

Both circuit tuning and circuit monitoring are always performed during ASP-system commissioning. In addition, especially circuit monitoring is an essential and powerful tool when doing ASP-system troubleshooting.

8.4 Circuit Monitor

Note that the circuit monitor only is intended for advanced users.

The *Circuit Monitor* feature in AMT provides a user-friendly interface to low level ASP system performance monitoring. It supports the following:

- Circuit communication monitoring with communication statistics and log functions.
- Command interface for sending ON/OFF and FLASH-commands.
- LMS and SIU version query support.

The best way to learn how to make the most use of the *Circuit Monitor* is to actually use it. Therefore this part of the document is written like a basic walk through with the objective to get the user accustomed with the basic properties and procedures associated with the *Circuit Monitor* functionality in AMT.

8.4.1 Monitoring Circuit Communication

The left half of the Circuit Monitor Screen (below) contains a matrix where the rows correspond to *time slots* (TS) and the columns to *sync words* (S:). In every location where a time slots and a sync word meet, an FCU can be configured to communicate.

Start the communication sequence by pressing the *Start* button or *F11*. Depending on the system configuration file content one or several columns will soon be filled with signal level data. A red dot indicates the time slot and sync word combination for the FCU currently selected in the *FCU Id* box. By selecting another *FCU Id* the red dot will change location based on the communication parameters of the FCU selected. Note that

whether FCUs are in sequence or not with reference to time slots and sync word numbers depend on the configuration.

The number next to the red dot is the *received* signal strength for the selected FCU. The colour indicates the commanded state where green corresponds to ON (or DETECTION if it's a SIU), e.g. 43, and white to OFF (or NO DETECTION if it's a SIU), e.g 45. A communication problem with the selected FCU is indicated with a red colour, e.g 05.

All system events such as status changes or orders are logged in the window at the bottom of the main *Log* window. The log window can be enlarged by dragging the vertical splitter bar up or down.

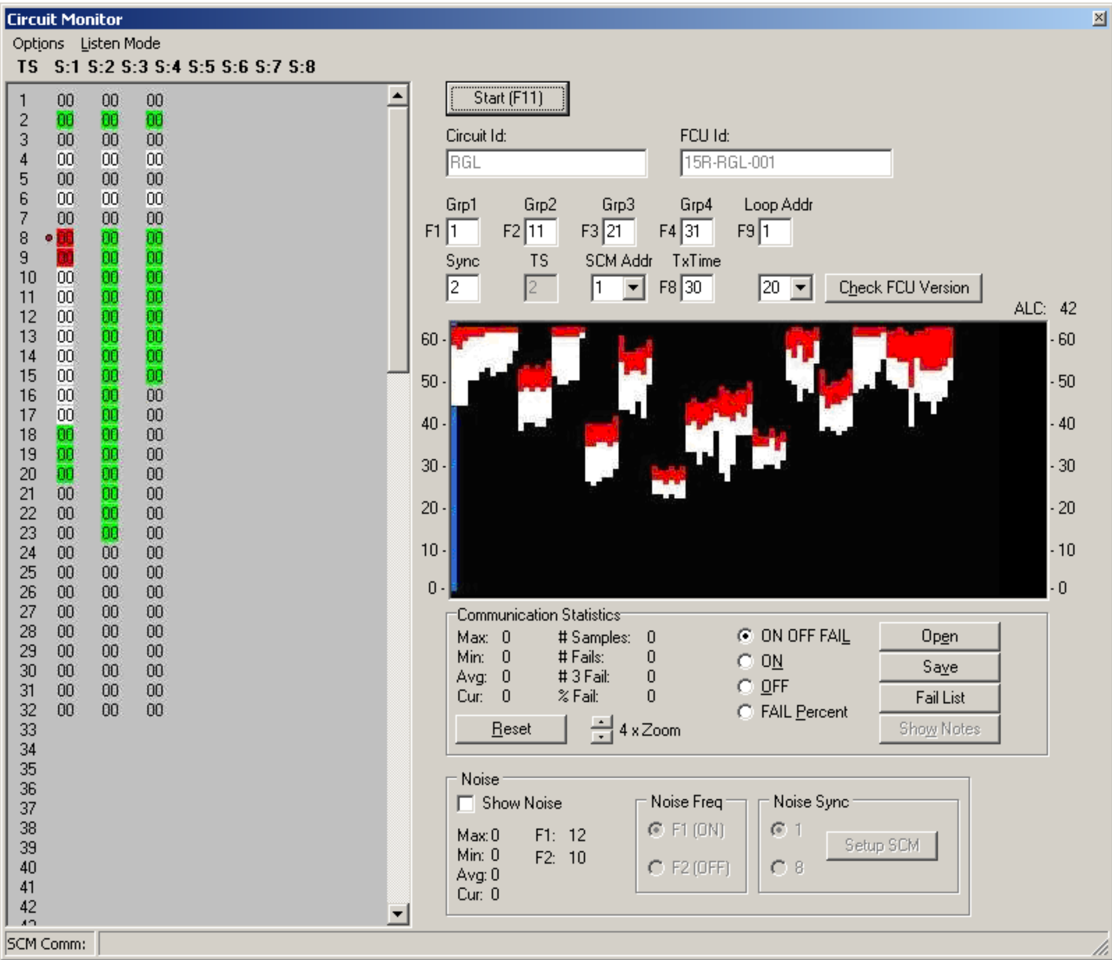


Figure 13. *AMT Circuit Monitor user interface.*

In the middle to the right a graphical presentation of the signal levels is displayed. A blue cursor indicates the position of the FCU currently selected. A zoom feature allows the user to zoom-in on or zoom–out off the graph.

The panel below the graph, labelled *Communication Statistics* displays the following numerical statistics for the selected FCU:

- Maximum signal level value monitored, Max.
- Minimum signal level value monitored, Min.
- Average signal level value monitored, Avg.
- Number of communication cycles, #Cycles.

- Number of communication dropouts, #Fails.
- Number of communication dropouts three in a row, #3Fail.
- Percentage of communication failures, %Fail.

By pressing the *Reset* button, statistics are reset and communication cycle counter restarts from zero.

All statistics graphically presented can be filtered to a certain degree. The type of filter used is controlled by the four item radio buttons below the graphical display where:

- ON OFF FAIL, considers signal levels for all report states, i.e. ON and OFF and in addition communication failure (FAIL).
- ON, filters out all data except signal levels received where the matching state is ON.
- ON, filters out all data except signal levels received where the matching state is OFF.
- FAIL Percentage, displays only fail percentage data.

By pressing the *Fail List* button a list of all FCUs with a least one communications failure will be displayed.

Statistics can be saved for later processing by pressing the *Save* button. When doing so the user will have the possibility to enter some comments, which will be saved with the data.

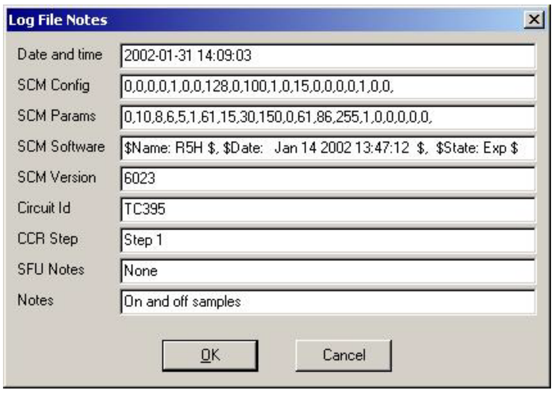


Figure 14. *Circuit Monitor Log file notes.*

Data recorded at a previous occasion may be displayed graphically at any time by opening the corresponding log file by pressing the *Open*-button, the log viewer window will then be shown. Press *Show Notes* to view the log file notes saved with the data.

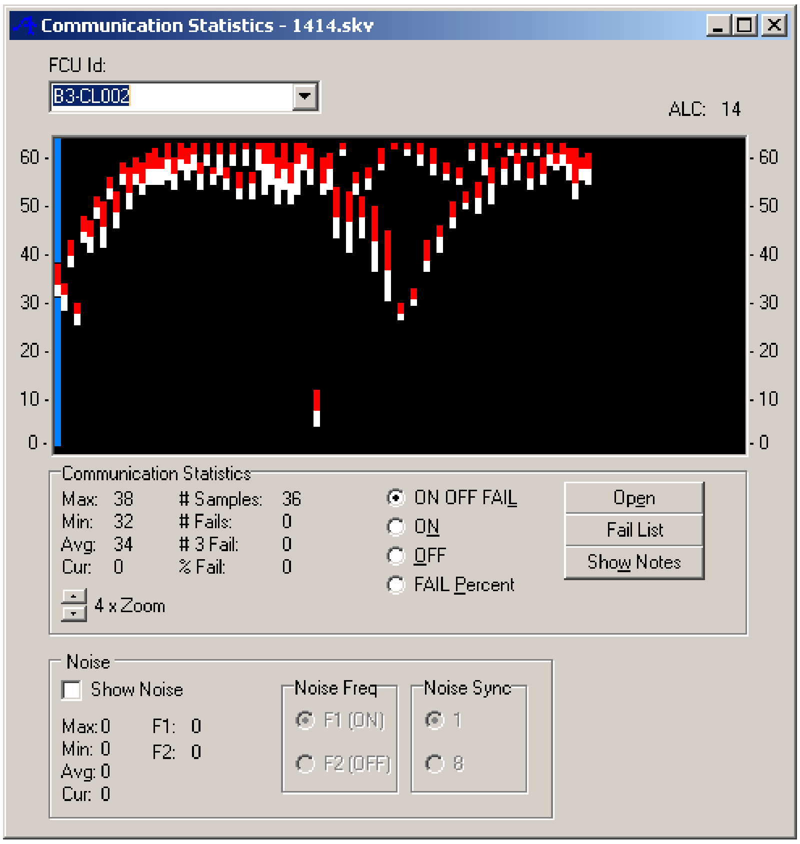


Figure 15. *Circuit Monitor Log file viewer.*

8.4.1.1 Evaluation of monitored communication

To be able to evaluate if monitored signallevels are good or bad, the signallevels must be related to a threshold value. This threshold value determines if a lamp/FCU shall be reported as failing, i.e if its signallevel is lower than the threshold value. This threshold is normally set right between the lowest signallevel for any FCU on the circuit and the noiselevel of the background noise that always exist on a series circuit. The threshold value is defined among all other SCM parameters, and is called MDL – Minimum Detection Level (see 13.5.3.2), and must not be modified without consulting a very advanced user.

To find out the noiselevel on a series circuit can only be done by a very advanced user, because the noiselevel is dependent on a number of things, e.g. CCR-intensity, noise crosstalk from nearby circuits, system configuration etc. A simplified method is to measure the noiselevel on a series circuit is to look at an "empty" syncword-timeslot-combination in the signallevel-matrix, such a position can normally be found for timeslots in the first row of the matrix. The signallevel that is presented in an "empty" timeslot syncword-timeslot-combination is the noiselevel, note that this noiselevel is not graphically presented but can only be read in the matrix.

Generally can be said that:

1. If the signallevel from a FCU is constantly below the threshold value, signallevel marked red, indicates that there is a faulty lamp/LMS.
2. If the signallevel from an FCU varies between red marking and green or white marking, may (or may not) indicate that the FCU or cablage/contacts to the FCU are faulty.

Note if situation 1 arises, that implies that the faulty lamp/LMS also is reported and presented in the host control system and to correct that problem, the normal maintenance procedures shall be performed.

If on the other hand the situation 2 arises, that must not necessarily mean that it is reported and presented to the host control system. This situation may (or may not) indicate a potential problem. A very advanced user should be consulted.

8.4.2 Sending Commands

The upper right corner of the circuit monitor display contains a number of buttons dedicated to various kinds of commanding of the FCUs on the series circuit being monitored.

To command an individual FCU select it from the *FCU Id* box and press:

- F9 to turn the lamp off.
- Ctrl + F9 to turn the lamp on.
- Shift + F9 to flash the lamp.

Note that *Loop Address Cmd* must be selected in the *Settings* menu (see 13.7.4) before this type command can be used. All FCU-types does not support this type of command.

To command a group to which a particular FCU belongs, select the FCU from the *FCU Id* box and press:

- F*x* to turn the lamp off.
- Ctrl + F*x* to turn the lamp on.
- Shift + F*x* to flash the lamp.

Since an FCU can belong to several different groups replace F*x* above with F1, F2, F3 or F4 depending on the configuration for the FCU selected. Note that a group command will most likely affect other FCUs on the circuit apart from the one selected.

8.4.3 FCU Version Query

An FCU version query checks the firmware version for a selected FCU. First select the firmware version you would like to check in the list to the left of the *Check FCU Version* button and then click the button. The responses from the selected sync word are displayed in the response matrix to the left. This implies that even though a particular FCU is of interest all FCUs on the same sync word will respond. A green response colour corresponds to a matching firmware version while an amber response colour corresponds to a mismatch.

8.4.4 Menu Command Reference

Selecting *Settings* from the menu will display four options:

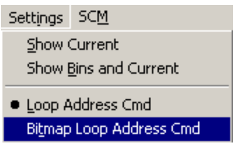


Figure 16. *Settings Menu*

- *Show Current*: Shows the approximate current in amperes. This function **will need** a change in one of the SCM parameters to work.
- *Show Bins and Current*: Shows the approximate current in amperes. This function **will not need** a change in one of the SCM parameters to work.

- *Loop Address Cmd*: Enable/disable this particular type of command. Refer to 13.7.2 for reference.
- *Bitmap Loop Address Cmd*: Outside the scope of this document. Always disabled.

8.4.5 Other Commands

The circuit monitor function in AMT supports apart from the above-mentioned commands and features some additional ones. Since they are intended for very advanced users only they are outside the scope of the document.

One such feature is the *TxTime* button to the left of the *Check FCU Version* button or the Show Noise function at the bottom of the screen.

9 ADVANCED FUNCTIONS

The advanced functions are part of AMT Pro and are only available for privileged or administrator users.

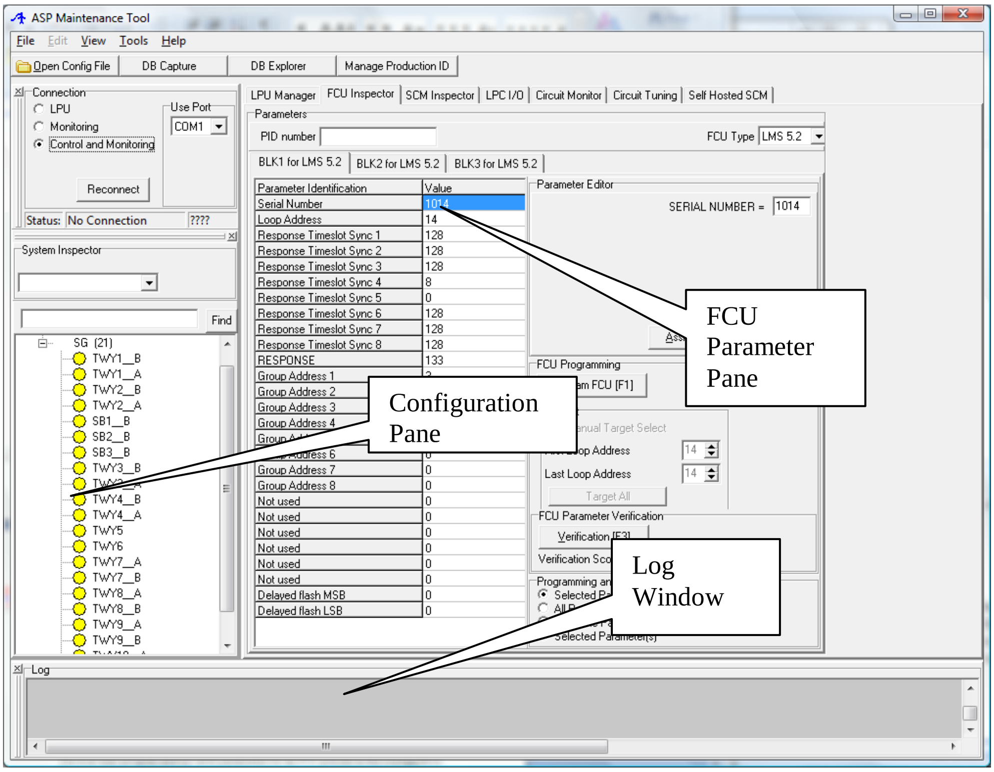
9.1 FCU Maintenance

Not all versions of AMT support *FCU Maintenance* as described below.

The term *FCU Maintenance* refers, in this document, to the process of working with LMS- or SIU-parameters in terms of modification and/or verification.

9.1.1 User Interface

The FCU Maintenance user interface consists of three main components: the parameter pane, the configuration pane and the log window.



The user may change the size of the window according to his preference.

9.1.1.1 The Configuration Pane

In order to use the configuration pane an *ASP System configuration file* is needed. If this type of file is available, load the file by either pressing the *Open Config File*-button . AMT will automatically or semi-automatically convert older version configuration files. In the latter case the user will be prompted for additional information.

From the configuration file, in the Configuration Pane, the user may select an individual FCU by clicking on it. This will transfer the parameters for the selected FCU to the Parameter Pane.

The user may program and/or verify parameters for an FCU present in the configuration file.

Programming and verification is always performed on FCU-level in the configuration pane as opposed to parameter or parameter block level in the FCU parameter pane.

If no configuration file exists the user will still be able to perform *FCU Maintenance* from the FCU Parameter Pane.

9.1.1.2 The FCU Parameter Pane

The FCU Parameter pane is basically a parameter editor which allows the user to modify (program) and verify parameters for several FCU-types.

The user selects the FCU-type from the combo-box in the upper right hand corner of the FCU Parameter Pane.

The tabbed parameter set will automatically reflect the properties of the FCU-type selected both in terms of the number of parameter sets and the parameters contained therein.

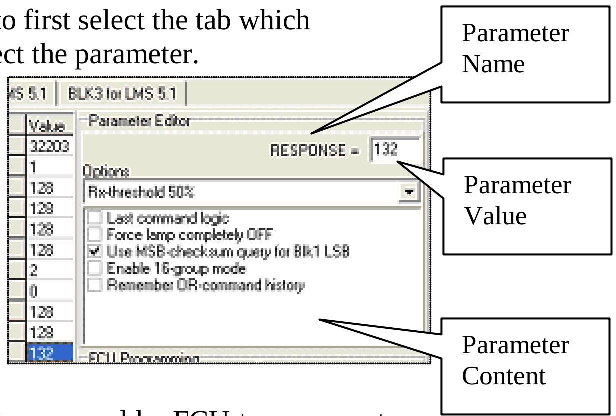
Furthermore, the programming and verification options will adjust to correspond to the capabilities of the FCU-type currently selected. When switching from one FCU-type to another the parameter values for the type switched out are saved.

9.1.1.2.1 Editing Parameter Values

To edit a particular parameter value the user has to first select the tab which contains the proper parameter block and then select the parameter.

When a parameter is selected the *Parameter Editor*-panel will show all the options associated with the particular parameter.

The user may enter the parameter value directly or select and/or check/uncheck the options presented.



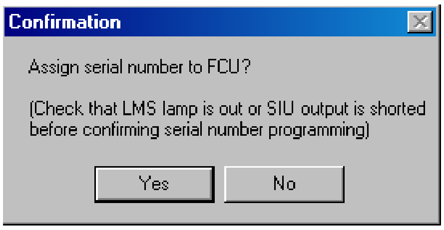
9.1.1.2.2 Programming Parameters

The programming options vary depending on the capabilities of the FCU-type selected. In general terms on older FCU-type supports less sophisticated options.

The basic programming options allows for programming an individual parameter block or a full parameter set. The more

advanced programming options supported by the newer FCU-types include single parameter programming and subset programming including target range selection. The user selects what to program from the *Programming and Verification Scope* radio buttons. The options available are:

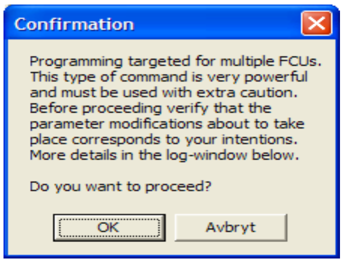
- *Selected Parameter Block* which will program the complete parameter block visible on the currently selected tab.
- *All Parameter Blocks* which will program all parameter blocks on all tabs applicable to the selected FCU-type.
- *Complete Parameter Set* which will program all parameter blocks exactly as *All Parameter Blocks* but in addition include *Serial Number Programming* or any other type of programming which require the user to perform manual procedures like for example removing the lamp or shorting the SIU output. In this case the user is notified a requested to confirm the action before proceeding. *Complete Parameter Set*-programming is usually only executed when a FCU is replaced and hence not when connected to the series circuit but to an LPU.



- *Selected Parameters* which programs only the parameter(s) currently selected by the user. The user may select several parameters in one parameter block by holding down the <*shift*>-key and pressing the ↓-key one or more times. If multiple parameter selection isn't supported by the selected FCU-type or parameter block the selection will dissapear as soon as the <*shift*>-key is released.

In cases where the user may program a set of FCUs with the same parameters the *Target*-panel will be visible and enabled. The default selection is the currently selected FCU.

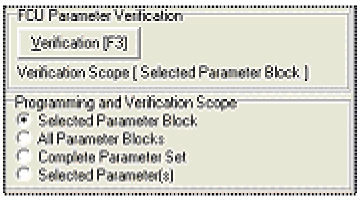
The user is also given the opportunity to confirm actions which requires extra care, which is the case for target ranges including multiple FCUs.



Finally, to invoke the programming press the *Program FCU*-button or F1.

9.1.1.2.3Verifying Parameters

Verifying parameters uses the same procedure as for the programming. The user selects the scope for the verification from the same radio-buttons used for selecting the programming scope. The options available will depend on the FCU-type selected and its capabilities.



The most basic verification is single parameter block verification which is supported by all FCU-types. More advanced is the single parameter or parameter subset verification.

Finally, to invoke the verification press the *Verification*-button or F3.

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9.2 Circuit Tuning

Note that the circuit tuning tool only is intended for advanced users.

9.2.1 Why circuit tuning?

9.2.1.1 ASP system power cable communication

The ASP-System is designed to provide individual monitoring of airfield lighting using the series circuit as a means of communication for the monitored status of the lamps and sensors in the airfield.

All series circuit communication signalling information is provided by the Concentrator Unit (CU) and passed on through a Series Circuit Modem (SCM) to a standard isolation transformer which interfaces the signalling to/from the series-circuit. A Series Circuit Filter (SCF) is connected across the constant current regulator (CCR) series circuit output and is used to contain the signalling within the airfield circuit and minimize feedback into the regulator. Communications between the SCM and the LMS and SIU in the airfield is provided by power line carrier, where the signals are interfaced to the series-circuit power cable through a standard isolation transformer connected to the SCM and the same in the airfield for each LMS/SIU.

The communication between SCM and LMS/SIU on the power cable is based on a Safegate proprietary communication protocol where SCM acts as a master, sending status queries and commands to the LMS/SIU, and the LMS/SIU responds accordingly. The data communication protocol is coded by different signal frequencies that are superimposed on the power line carrier.

9.2.1.2 Circuit tuning principles

Circuit tuning is a procedure that is performed at commissioning of an ASP system, to adopt the communication between SCM and LMS/SIU to the specific series circuit, and thereby optimising the communication reliability. Because the power cable communication between SCM and LMS/SIU is dependent on circuit layout, circuit load and circuit insulation resistance, the circuit tuning must be done for each circuit individually.

9.2.1.3 Frequency tuning

Frequency tuning is one part of the circuit tuning procedure performed at system commissioning. The frequency tuning procedure is a method to find the best signal frequencies for each LMS/SIU to use in the communication with the SCM. What frequencies are best to use is, as mentioned earlier, dependent on circuit layout, circuit load and circuit insulation resistance. That implies that if any of these circuit characteristics changes on an already commissioned system, the ASP communication can be degraded.

9.2.1.4 A word of caution

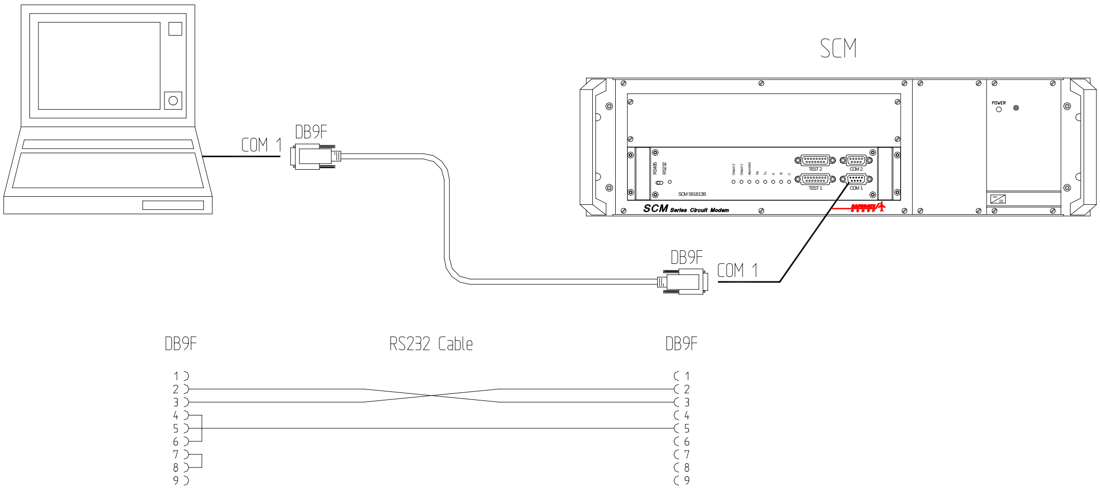
Frequency tuning for resolving communication problems, without supervision of Safegate authorised personnel, is not something that should be done without thought. First must be concluded that the communication problems are not due to installation problems, LMS failures, earth faults etc, see ASP system maintenance manual for troubleshooting. If a frequency tuning is run before such errors are cleaned up, there is a large possibility that the result does not get satisfactory, and the tuning procedure must be run again with the circuit clean.

9.2.2 Frequency tuning by AMT

Frequency tuning by AMT is a fully computerised method to find the best signal frequencies for the communication between SCM and LMS. AMT makes it possible to connect a maintenance laptop to the COM1-port on a SCM and run the AMT software to automatically optimise the communication on the specific series circuit.

9.2.2.1 Hardware setup

A maintenance computer with AMT installed connects to the series circuit that is intended to be tuned, via a null-modem RS232-cable connected to the computer COM-port and the COM1-port on the front panel of the SCM. Put the *Remote/Local* switch on the front panel of the SCM to *Local*.



9.2.2.2 AMT frequency tuning principles

AMT will, through the SCM, communicate with every LMS on a circuit at a number of predefined frequencies. After all frequencies have been tested, AMT will select the best frequencies to use for each individual LMS, and update the circuit with the result by downloading communication parameters for the selected frequencies both to the SCM and to all the LMS's on the circuit. The LMS- and SCM configuration database must thereafter be updated with the new assigned parameters.

9.2.2.3 Before starting AMT frequency tuning sequence

During the time an AMT frequency tuning sequence is running, all circuits on site but the one that is intended to be tuned, must either be communicating via the CU, or be de-energised. All circuits onsite also include circuits that run from another vault on the same RWY, but not circuits on other RWY's.

This precaution is to prevent undesirable interference with the circuit that is intended to be tuned.

9.2.2.4 AMT frequency tuning sequence

The ***ASP Circuit Tuning*** box will open. The box consists of a number of buttons and windows. The ***Session History*** window logs all actions with timestamp, a separate log window for low level details on the tuning sequence can be viewed if button ***Show Details*** is pressed. The remaining buttons and windows in the box will be explained later.

Open the appropriate LMS configuration file by selecting ***File*** → ***Open Config***, Figure 18. When the configuration file is selected, it is possible to select the circuit, which is intended to be tuned (and to which the SCM is connected to), Figure 19 and Figure 20.

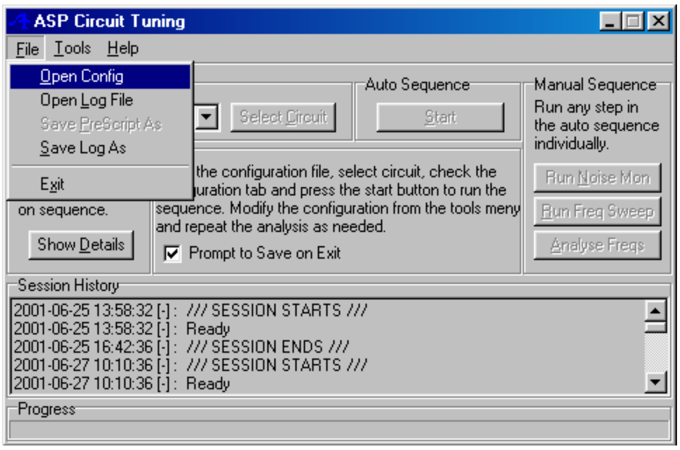


Figure 17. *The* ***ASP Circuit Tuning*** *box, open appropriate LMS configuration file.*

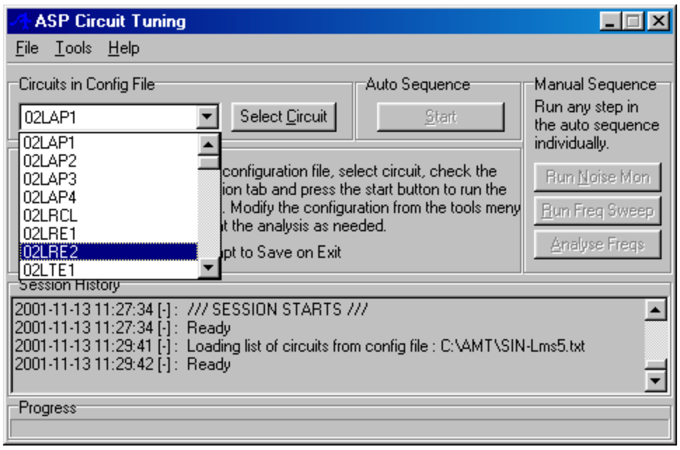


Figure 18. *The* ***ASP Circuit Tuning*** *box, select appropriate circuit.*

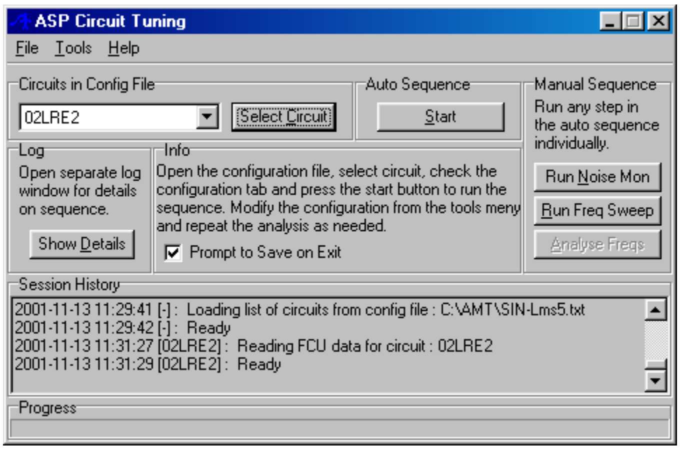


Figure 19. *The* ***ASP Circuit Tuning*** *box, circuit is selected.*

Before the frequency tuning can start, a number of parameters must be set. That is done by selecting ***Tools*** **→** ***Configuration***, Figure 21, and the ***Circuit Tuning Configuration*** box will opens, Figure 22. There are five flaps with settings, ***General***, ***Frequencies, Optimization, Preferred Frequencies*** and ***Miscellaneous***, these settings are normally not modified, default settings are used, see Figure 22, Figure 23, Figure 24 and Figure 25.

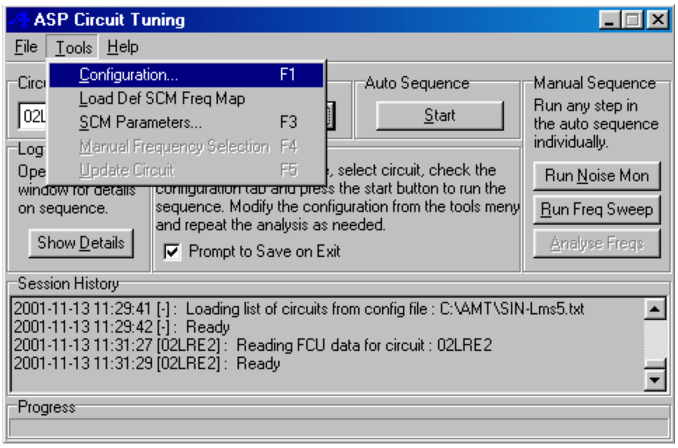


Figure 20. *The ASP Circuit Tuning box, select Configuration.*

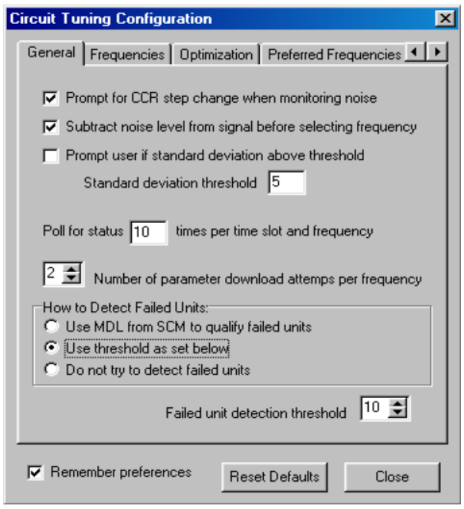


Figure 21. *Circuit Tuning Configuration box, General settings.*

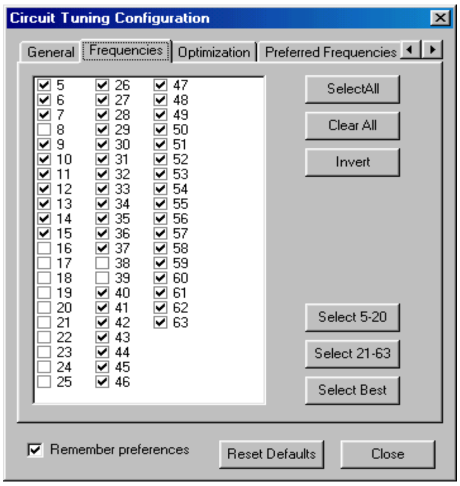


Figure 22. *Circuit Tuning Configuration box, Frequency settings.*

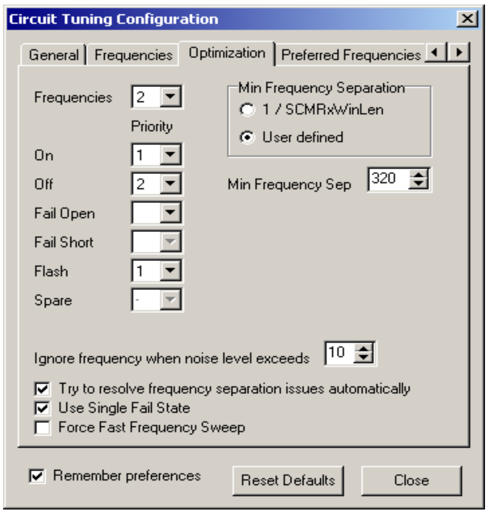


Figure 23. *Circuit Tuning Configuration box, Optimization settings.*

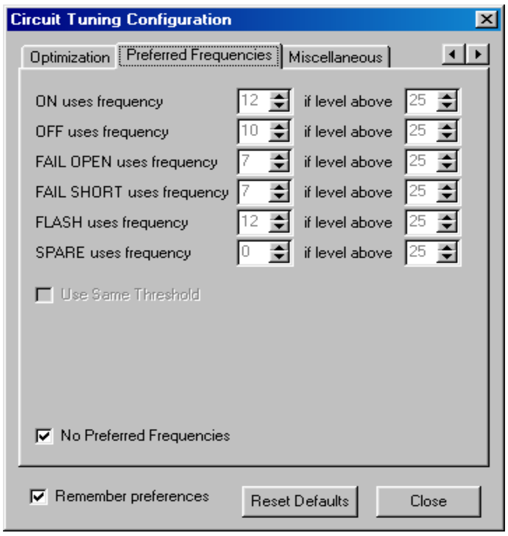


Figure 24. *Circuit Tuning Configuration box, Preferred Frequencies settings.*

Start the frequency tuning sequence by pressing the button ***Auto Sequence Start***. A dialogue box will open, asking if a complete sequence will be run, Figure 26, press the button ***Yes***.

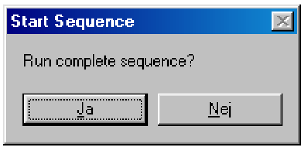


Figure 25. ***Start Sequence*** *box, press* ***Yes*** *button.*

Then the ***Monitor Noise*** dialogue box will open. The circuit noise will now be monitored at every CCR intensity step (current level). The reason why the noise is monitored is to make it possible for AMT to calculate signal-to-noise ratios. The CCR steps has to be set manually, first set the CCR on lowest operational intensity step and write a comment to the log file, for example "1%", Figure 27. Press the button ***Monitor Noise for This Step***, the SCM will now collect noise data for this CCR step. After a few seconds the ***Monitor Noise*** dialogue box will re-open, set the CCR intensity at the next higher intensity step and write a comment to the log file, for example "3%", and press ***Monitor Noise for This Step***. Continue to monitor the noise on all CCR intensity steps. When all steps are monitored, press ***Done*** in the ***Monitor Noise*** dialogue box. The ***Noise Monitoring*** dialogue box will open, that asks if all CCR steps are done, press button ***Yes***, Figure 28.

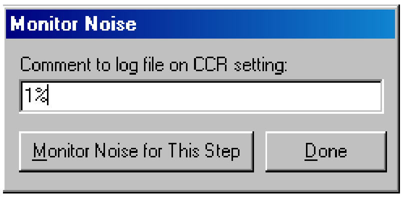


Figure 26. *Monitor Noise dialogue box.*

Figure 27. ***Noise Monitoring*** *dialogue box, press* ***Yes*** *button if all steps are done.*

The ***Frequency Sweep*** dialogue box will open, Figure 29. Set the CCR at desired intensity step, 10% is a suitable value. Press the ***OK*** button to start sequence.

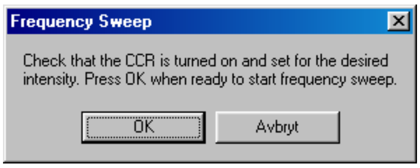


Figure 28. *Frequency Sweep dialogue box.*

Now the frequency sweeping process will start. That means all frequencies that are configured in the ***Circuit Tuning Configuration*** box, ***Frequency*** settings, Figure 23, will be tested (default values). Details on the tuning sequence can be viewed if the button ***Show Details*** in the ***ASP Circuit Tuning*** box is pressed, Figure 30, these low level

details will be saved in a text file in the end of the tuning process, and can be used by Safegate personnel for troubleshooting.

The progress bar in the ***ASP Circuit Tuning*** box monitors the progress of the frequency sweeping process, it takes several minutes, depending on the number of LMS's on the circuit.

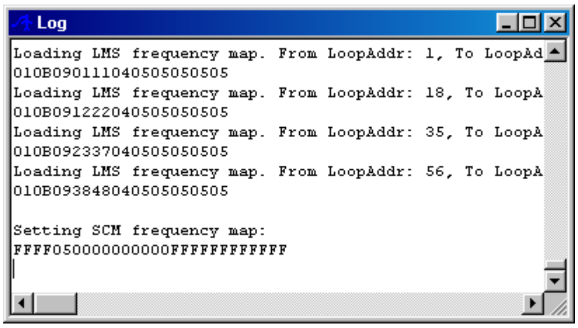


Figure 29. *Low level logging of frequency sweep.*

When the frequency sweep sequence has ended, AMT will start to download the best set of frequency parameters to each individual LMS. There may be a few LMS's that AMT has failed to find any frequencies to use, which can for example be due to that those LMS's are failing. Assignment of parameters to those LMS's must therefore be done manually. The ***Manual Frequency Mapping*** box will open and the user can manually assign communication parameters to those LMS's, Figure 31. All LMS's will be viewed in the ***Reference List*** window, and the non assigned LMS's in the ***Non Mapped*** window. The method to assign parameters to the non assigned LMS's is to select a LMS in the ***Non Mapped*** window and select the neighbour[3] LMS in the ***Reference List*** and press the button ***Assign***. This assignment procedure must be done for all non assigned LMS's in the ***Non Mapped*** window. The result of the manual assignments is viewed in the ***Mapped*** window, Figure 32.

It is also possible to do ***Auto Assign***, where AMT give the non mapped LMS's the same parameters as the LMS's that has fixture-ID number closest to the non mapped LMS's. This method is though not as accurate as the manual assignment because it is not in all cases true that the electrical neighbour to a non mapped LMS also has closest fixture-ID number.

A LMS that is manually or auto assigned in AMT during a frequency tuning <u>must</u> be programmed with the LPU after the parameter database has been updated.

[3] Neighbour LMS's means LMS's that are installed next to each other on the series circuit, from an electrical point of view. Note that two LMS's with fixture-ID numbers closest to each other not necessary need to be electrical neighbours, because often the fixtures are installed on different legs (out-going and in-going) of the primary circuit when the two primary cable legs are running in parallel through the same manholes. To figure out neighbour LMS's, it is necessary to examine the primary cable drawings.

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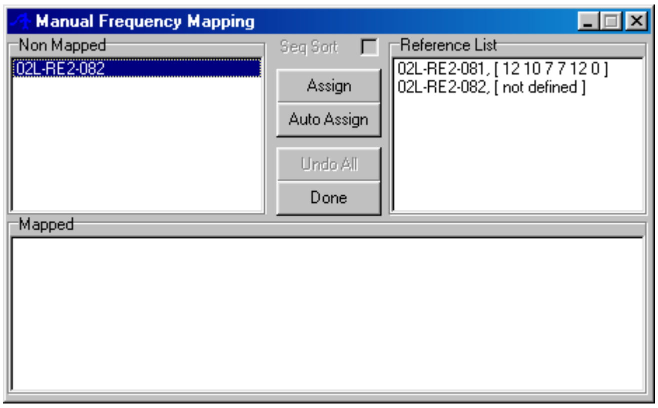


Figure 30. ***Manual Frequency Mapping*** *box. Select a LMS in the* ***Non Mapped*** *window and one of its neighbours in the* ***Reference List****, then press the button* ***Assign****.*

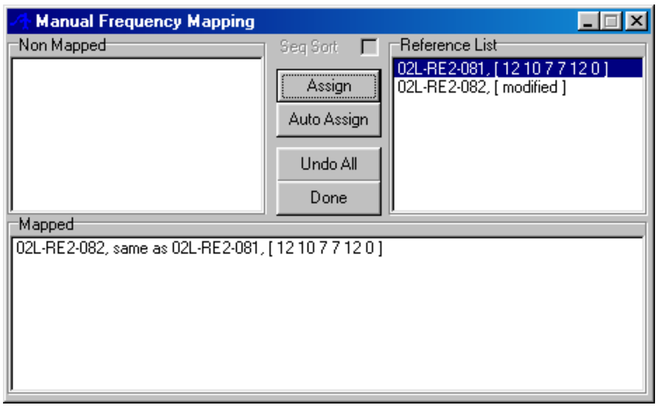


Figure 31. ***Manual Frequency Mapping*** *box. The result of the manual assignment procedure is viewed in the* ***Mapped*** *window. Press the button* ***Done****.*

Then it is time to update the circuit by downloading the new parameters to all LMS's on the circuit and the SCM. From the ***ASP Circuit Tuning*** box, select ***Tools*** **→** ***Update Circuit***, Figure 33. The ***Update Circuit*** dialogue box opens, to double check if the user really wants to update the circuit, Figure 34, press ***Yes***.

The progress bar in the ***ASP Circuit Tuning*** box monitors the progress of the update circuit process, it takes several minutes, depending on the number of LMS's on the circuit.

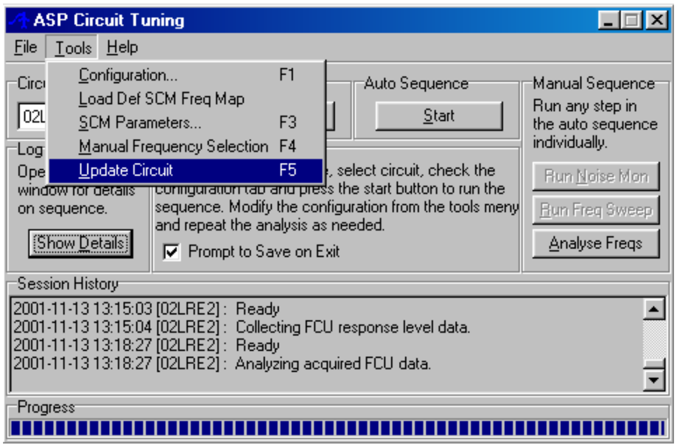


Figure 32. ***ASP Circuit Tuning*** *box, update the circuit with new frequency parameters.*

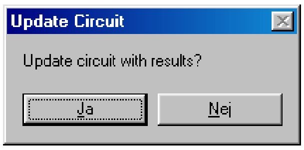


***Figure 33. Update Circuit** dialogue box, double check of circuit update.*

Now, the frequency tuning sequence is finished, the LMS's on the circuit and the SCM is updated with the new parameters. Exit the program from ***ASP Circuit Tuning***, select ***File → Exit***, Figure 35. The dialogue boxes ***Save Script*** and ***Save Log*** open, Figure 36 and Figure 37, and asks the user if he wants to save logging information to file. This information, if needed, can be used by Safegate personnel for troubleshooting purposes. The pretest script is not necessary to save but the log window content must be saved. The log window content should be given the default name *XXXXXX.log* where *XXXXXX* represents the circuit name, for example *02LRE1.log*.

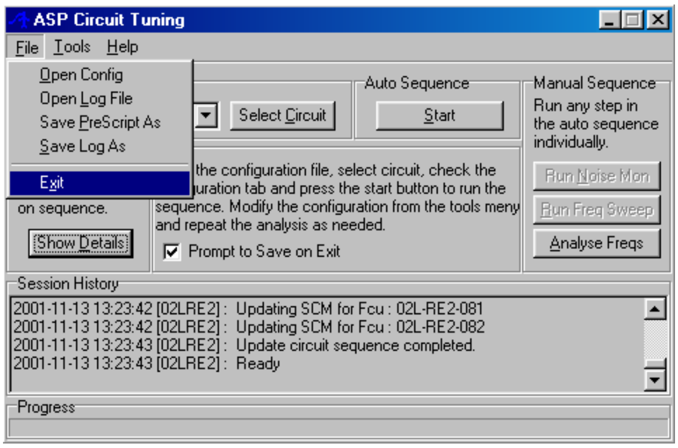


***Figure 34.** ASP Circuit Tuning, exit program.*

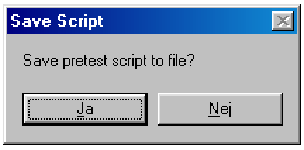


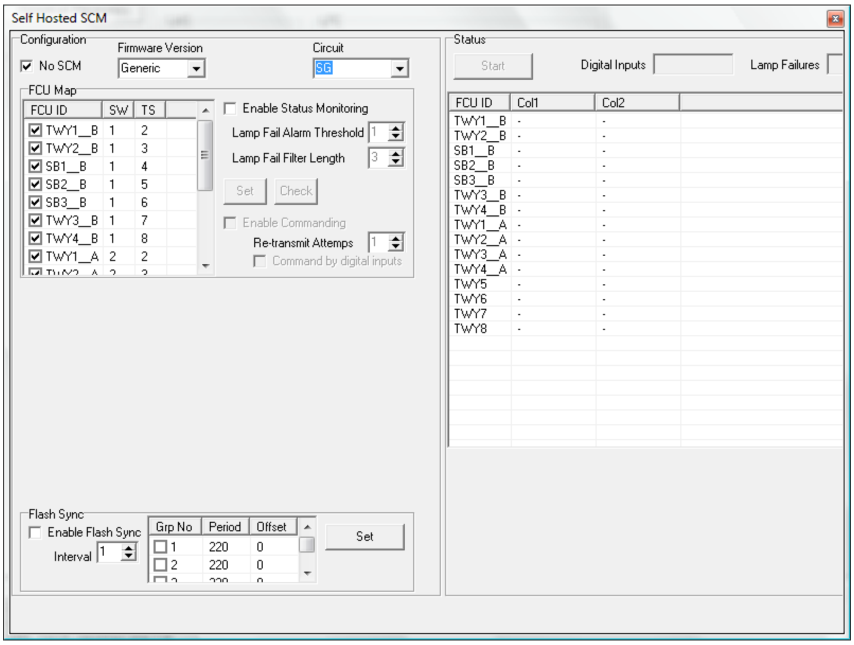
***Figure 35. Save Script** dialogue box, select **No**.*

***Figure 36. Save Log** dialogue box, select **Yes**.*

10 SELF HOSTED SCM

Some types of ASP system can be configured without a NCU. In those cases, the SCM will handle many of the functionalities that are normally handled by the NCU. The *Self*

Hosted SCM tool includes functionality to configure the SCM as well as monitor the resulting system functionality.



The tool window for *Self Hosted SCM* is divided into two parts:

- Configuration functionality
- Monitoring functionality

10.1 Configuration functionality

The configuration functionalities are on the left side of the tools window. The principles of the *Self Hosted SCM* concept is that the SCM handles both the communication on the series circuit as well as is aware of the operative configuration, i.e. what fixtures/LMS are on the circuit (information that normally is handled by the CU). The SCM can therefore monitor the lamp status, generate alarms or synchronise RGL flashing and other functionalities.

Uppermost in the configuration functions is the *FCU Map*, with which the complete, or selected parts of the configuration (marked in the list) for a specific circuit is downloaded to the SCM with the *Set*-button. If there is need to control the resemblance between the downloaded information and the information in a configuration file, which can be done with the *Check*-button. In the cases where downloaded records are the same as the content in the configuration file, the records in the list will be shadowed. To set a threshold value for summary alarm, a specific number of lamps, use the *Lamp Fail Alarm Threshold*. The filter length of the alarm threshold (i.e. the number of consecutive lampfail responses to set an alarm) use the *Fail Filter Length*.

The configuring of flash synchronising is set at the bottom of the configuring section of the tools window. The synchronising sequence is activated there, it is also configured for the groups included in the synchronising sequence and the *Offset* between the groups. The *Period* is calculated directly from the information in the configuration file and cannot be modified by the user. The interval between the synchronising sequences is set by *Interval* in number of minutes (50 seconds @ 60Hz mains).

<u>Note that the monitoring functionality always should be activated after configuration changes have been made, to verify that the system function.</u>

10.2 Monitoring functionality

The monitoring functionality is fully implemented in firmware 6025 and later.

The monitoring functionality is activated with the *Start*-button. State for every fixture is presented in the list, and the numbers of lamp failures are shown to the right. The monitoring continues as long as the SCM is active or *Stop* is pressed.

11 USER HANDLING

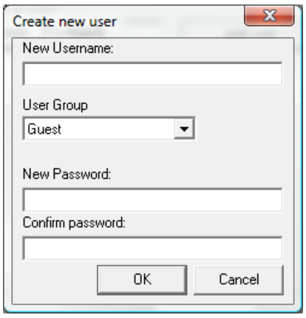
To get access to the functionalities in AMT, the user must, as previously described, log in when the program is started.

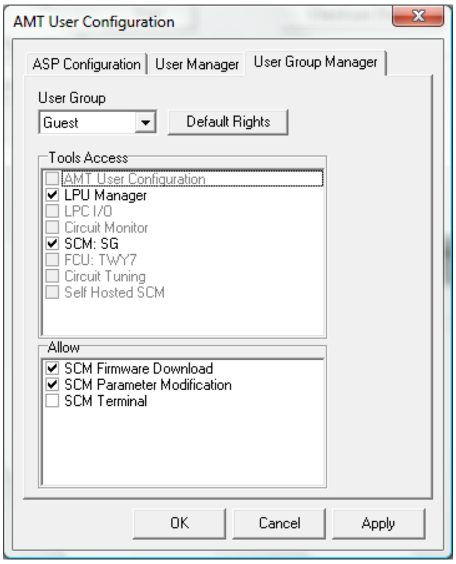
Depending on what access rights the user has, some functions in AMT can either be completely or partially blocked. Which functionality that is available is also depending on which variant of AMT that is used, see section 6.4

11.1 User groups

AMT is using four user groups to configure access privileges for individual users:

- Administrators
- Privileged users
- Users
- Guests





To each of the different user groups, access rights are configured, both access to different tools windows and access to specific functions within a tools window. The four user groups are in a hierarchic order in that way that *Administrators* are in the top and *Guests* are in the bottom of the hierarchical scale. *Administrators* have, per definition, complete access rights without any restrictions. As a consequence of that, an *Administrator* can give access rights for all other user groups, while a *Privileged User* are allowed to give access rights to *Users* and *Guests*, based on the access rights the *Privileged User* have been given. Similarly, a *User* can give access rights to *Guests*.

Privileged Users can only create users that belong to the user groups *User* or *Guests* (that is if *Privileged Users* have been given the access rights to create users).

To administrate users and/or give access rights for user groups, open *Admin Settings* from the *File/Preferences*-menu.

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12 APPENDIX

12.1 LPU

The LPU, LMS/SIU Programming Unit, consists of an SCM and an LPC.

Before programming an FCU you must have a proper setup of the hardware. APPENDIX A and APPENDIX B will help you to interconnect and setup the SCM and LPC correctly. Depending on if you program in Manual Mode or Remote Control Mode you choose a different setup procedure.

These procedures are described below: as Hardware setup in Manual Mode, and as Hardware setup in Remote Control Mode.

12.1.1 Hardware setup for Manual Mode

1. On the back of both the LPC and the SCM there is a small box. Interconnect the two units with the provided transparent shielded Ölflex cable, see Appendix B.
2. Turn the SCM on. The Power switch is on the back of the SCM. A green LED on the front should now be on.
3. The RS485/RS232 (Local/Remote) switch on the front of the SCM should be in the RS232 (Local) position. A red LED on the front should be on, indicating the local state.
4. Turn the Laptop/PC on and load Windows.
5. Start the AMT software.
6. Connect the Programming Cable between the SCM and the Laptop/PC. The connector labeled SCM must be connected to the SCM COM 1 outlet and the connector labeled PC must be connected to a COM port on the Laptop/PC. COM 1 is default, but any COM port can be selected in the Connection Manager, see 9 Communication settings.
   Also check the box on the Programming Cable. If the red LED is on, then press the Load switch and press the Reset switch on the box. The LED should now be off.
7. If you are using a Laptop, then connect the power adapter. A Laptop running on its own batteries might not be able to deliver enough power to the COM port for reliable communication.
8. For programming in Manual Mode you do not need to interconnect the LPC and SCM, using two cables with 25 pins D-SUB connectors on the back of the LPC and SCM units.
9. For manual programming release the **Remote** switch on the LPC (set the LOCAL/REMOTE switch to LOCAL on an LPC version 2). Turn on the green main switch on the LPC.
10. Press the OUTPUT POWER switch, the green button marked I, on the LPC.

12.1.2 Hardware setup for Remote Control Mode

Follow these steps before programming an FCU in Remote Control Mode:

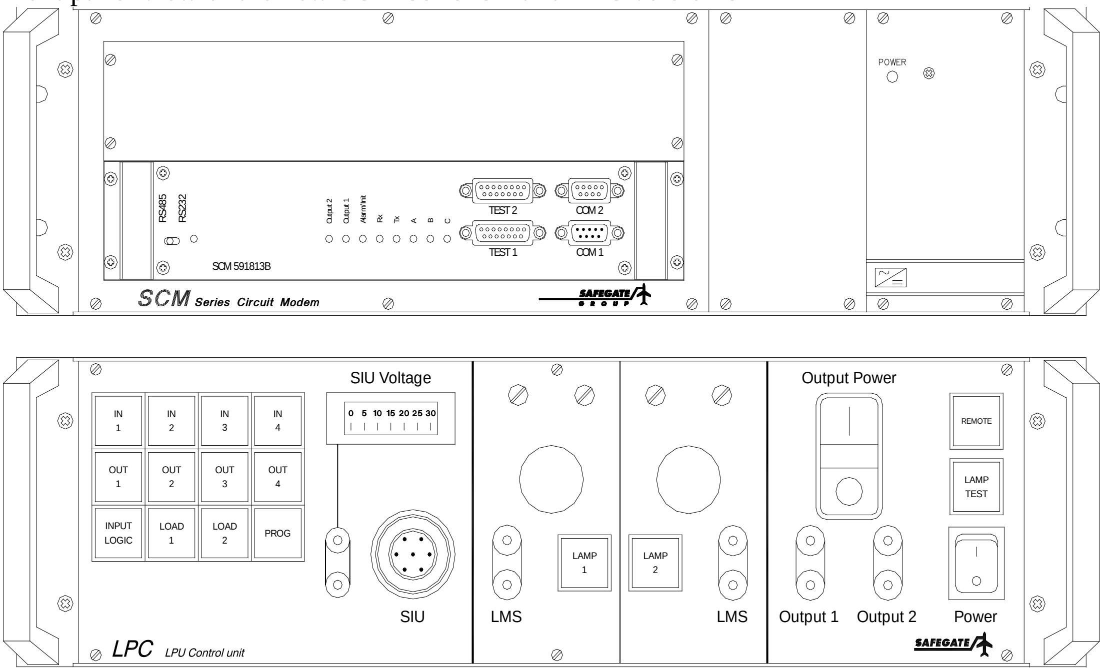
1. On the back of both the LPC and the SCM there is a small box. Interconnect the two units with the provided transparent shielded Ölflex cable, see Appendix B.

2. Turn the SCM on. The Power switch is on the back of the SCM. A green LED on the front should now be on.
3. The RS485/RS232 (Local/Remote) switch on the front of the SCM should be in the RS232 (Local) position. A red LED on the front should be on, indicating the local state.
4. Turn the Laptop/PC on and load Windows.
5. Start the AMT software.
6. Connect the Programming Cable between the SCM and the Laptop/PC. The connector labeled SCM must be connected to the SCM COM 1 outlet and the connector labeled PC must be connected to a COM port on the Laptop/PC. COM 1 is default, but any COM port can be selected in the Connection Manager, see 9 Communication settings.
   Also check the box on the Programming Cable. If the red LED is on, then press the Load switch and press the Reset switch on the box. The LED should now be off.
7. If you are using a Laptop, then connect the power adapter. A Laptop running on its own batteries might not be able to deliver enough power to the COM port for reliable communication.
8. For programming in Remote Control Mode you need to interconnect the LPC and SCM, using two cables with 25 pins D-SUB connectors. The outlets are found on the back of these units. Safegate can provide Cables.
9. For programming in Remote Control Mode turn on the **Remote** switch (set the LOCAL/REMOTE switch to REMOTE on an LPC version 2).
10. Turn on the green main switch on the LPC.

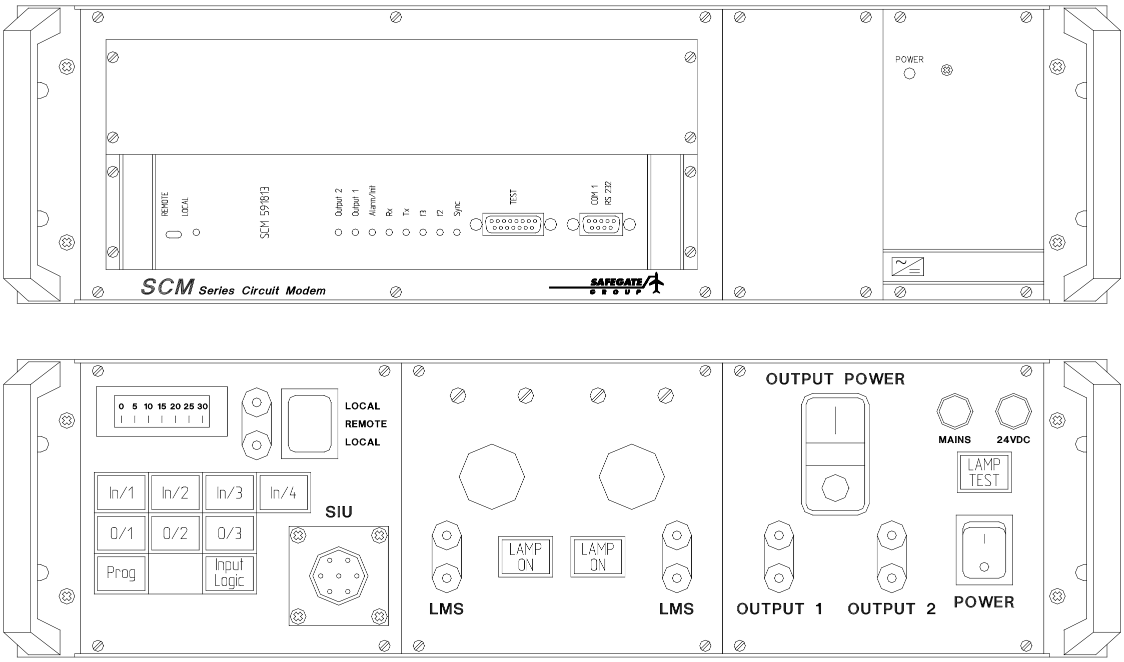
APPENDIX A

SCM AND LPC FRONT PANELS

Front panel view of the new SCM 591813B and LPC version 3



Front panel view of SCM 591813 and LPC version 2



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APPENDIX B

SCM AND LPC REAR VIEW AND INTERCONNECTION

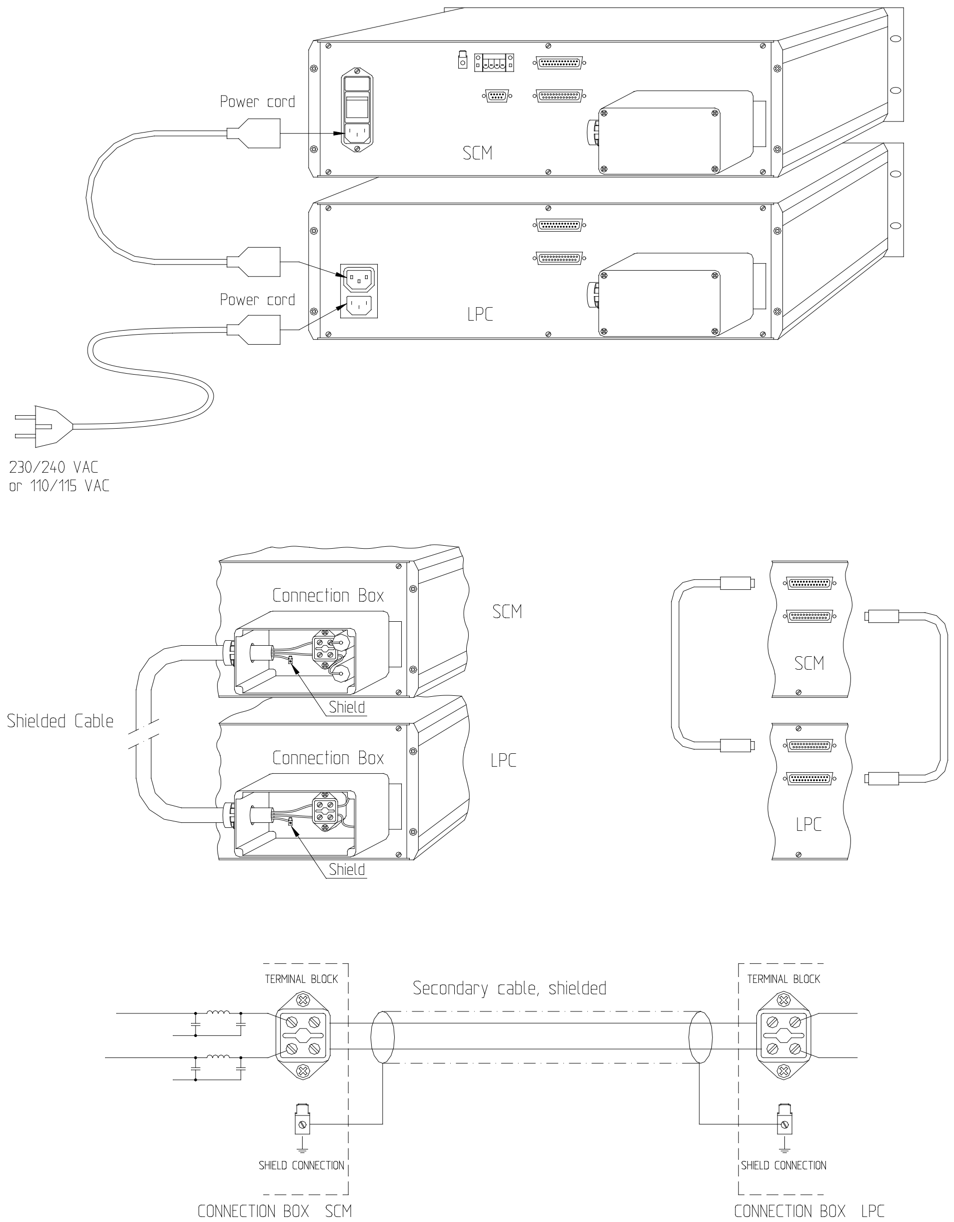

Figure displays the rear of an SCM and LPC, and how these units are interconnected.

Signal Filter Unit
591876-B
591877-B
591878-B

User's Guide

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CONTENTS

1 Revision history **3**
2 Scope **3**
3 Application **3**
4 Abbreviations **3**
5 Introduction **3**
6 SFU general description **4**
6.1 Specification 4
6.1.1 Electrical och mechanical specification 4
6.1.2 Function 5
7 Installation **5**
7.1 Installation hardware 5
8 Maintenance **5**
9 Troubleshooting **6**

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comments*
JF	2001-10-10	0.0	Draft.
JF	2002-03-11	1.0	Frisläppt
JF	2002-10-09	1.0	Translated to english

2 SCOPE

This document describes the ASP component SFU, Signal Filter Unit.

3 APPLICATION

This document applies for SFU 591876-B, 591877-B and 591858-B. It includes specification, installation, maintenance and troubleshooting of SFU.

4 ABBREVIATIONS

ASP	-	Airfield Smart Power
SFU	-	Signal Filter Unit

5 INTRODUCTION

The purpose of the SFU is, if necessary, balance the ASP-system communication signals that are superimposed on the series system power cables.

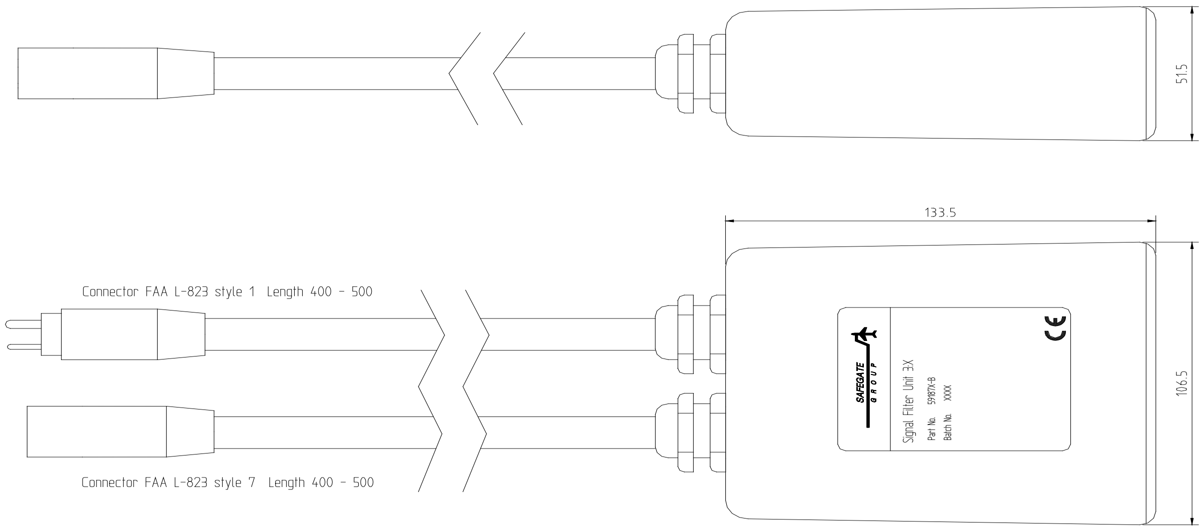
6 SFU GENERAL DESCRIPTION

6.1 Specification

6.1.1 Electrical and mechanical specification

Unless differently noted, all maximum values are absolute maximum values.

Characteristics		Symbol	Min	Typ	Max	Unit
Series circuit						
Supply power from series circuit (50/60Hz)		$I_{matning}$	2.5	-	7.1[1] 8.2[2]	A_{RMS}
Isolation voltage		V_{ISO}	1500	-	-	VAC
Connecting isolationstransformer[3]		P_{IT}	200	**200**	200	W
Power dissipation		P_{loss}	0	-	10	W
Environment						
Humidity		RH	0	-	100	%
Ambient temperature operation		T_A	-30	-	+65	°C
Ambient temperature storage		T_{STG}	-30	-	+100	°C
Encapsulation		IP68				
Mechanical data						
Dimensions without cablage	Width	L_b	-	**106.5**	-	mm
	Length	L_l		**133.5**		
	Height	L_h		**51.5**		
Secondary cablage (FAA L-823 class A contacts)		L_k	-	**400**	-	mm
Weight			-	**1.8**	-	kg



[1] According to FAA advisory circular 150/5345-47A (Isolation transformer for airfield visual aids).
[2] During max 1 second, according to FAA advisory circular 150/5345-10E (specifications for constant current regulators).
[3] Optimal functionality is obtained with Amerace 200W isolation transformer type TA200665-01.

6.1.2 Function

The purpose of the SFU is, if necessary, balance the ASP-system communication signals that are superimposed on the series system power cables.

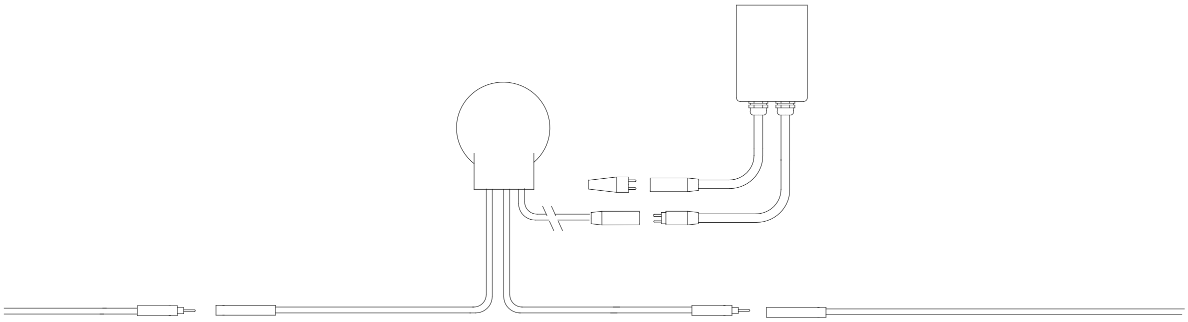
It is a fully passive component, without possibility to communicate with other parts of the ASP-system. The SFU is manufactured with rigorous requirements to obtain a robust system design that maximizes the reliability of the system. The SFU comes in three versions, SFU3:1 (591876-B), SFU3:2 (591877-B), SFU3:3 (591878-B), they are mechanically identical but have different filter characteristics.

7 INSTALLATION

7.1 Installation hardware

The SFU male contact is connected to the series circuit with an isolation transformer (Amerace 200W type TA200665-01). The female contact is either connected to a short circuit plug, or to another SFU (that is connected to short circuit plug).

To determine where on the series circuit the SFU should be installed for maximum performance is normally done during commissioning . The SFU installation is documented with respect to series circuit, position and type.



8 MAINTENANCE

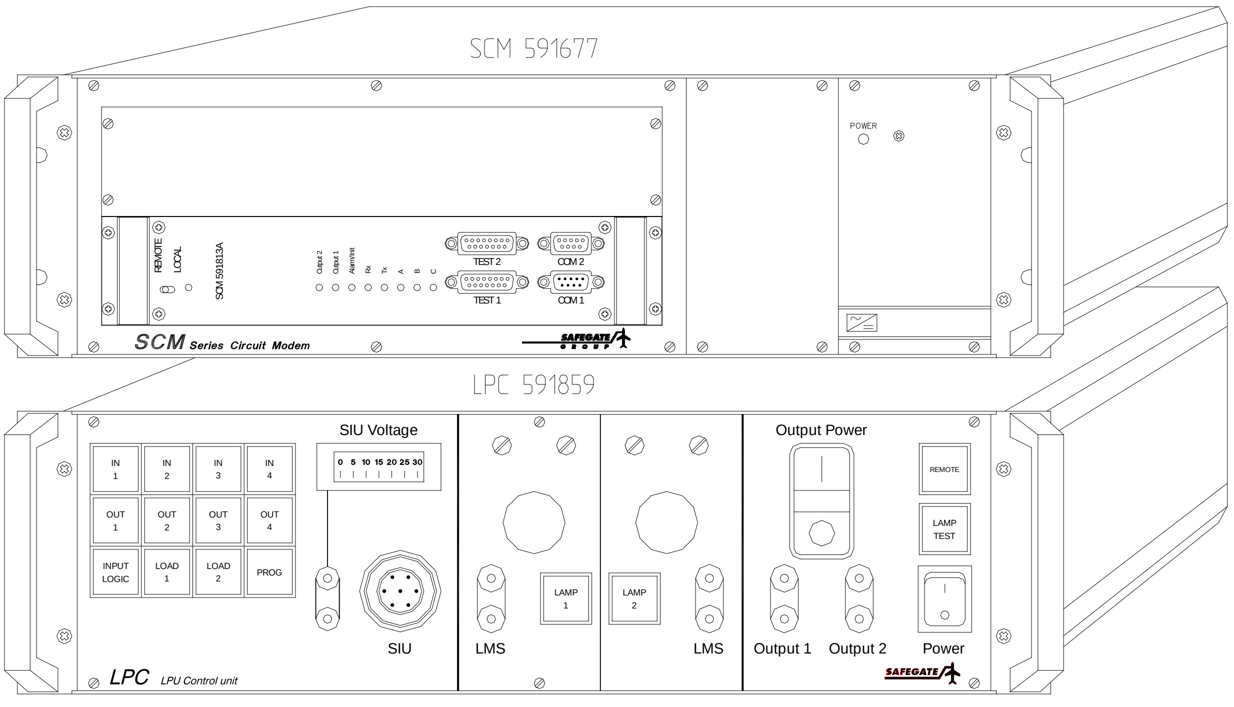
No maintenance is needed after installation.

9 TROUBLESHOOTING

Because the SFU is a passive component, there is no feedback to the system that indicates component status (OK/fail). If a SFU is failing, it is likely that there will be a situation where the SCM-LMS communication ability will be decreased within a small isolated area on the series circuit, which can result in false lamp/LMS-failures within that area. Normally the SFU's are installed on only one position on each series circuit, so identification and replacement of a failing unit is a simple process.

LPU 591862 / LPC 591859

User's Guide



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CONTENTS

1 Revision history 3
2 Scope & Application 3
3 Abbreviations 3
4 References 3
5 Description 4
5.1 General 4
5.2 Specifications 4
6 Connections, Control Panel, etc. 5
6.1 Rear 5
6.2 Front 6
6.2.1 SIU-section 6
6.2.2 LMS-section 7
6.2.3 General functions 7
6.3 Internal 7
7 Set up 8
7.1 Connecting SCM 8
7.2 Connecting PC 9
7.3 Connecting LMS 9
7.4 Connecting SIU 9
8 Maintenance 9

1 REVISION HISTORY

Version	Date	Remark	Author
0.1	2003-03-19	Document created	ÅP

2 SCOPE & APPLICATION

This document gives an introductory description of ***LPU – LMS/SIU Programming Unit***, made up by the LPC and the SCM, with **LPC 591859 ver. 3 in focus**.

For details on the SCM, refer to the SCM User's Guide.

This document describes the set up, control panel, function, some maintenance issues, etc. for the LPC.

When it comes to instructions for functional test or programming of LMS and SIU, please refer to the AMT User's Guide.

3 ABBREVIATIONS

ASP	Airfield Smart Power
CCR	Constant Current Regulator
SCM	Series Circuit Modem
LPC	LMS/SIU Programming Control unit
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
MBD	Microwave Barrier Detector
AMT	ASP Maintenance Tool (Windows application)

4 REFERENCES

SG591891-3001	AMT User's Guide
X0085	SCM User's Guide

5 DESCRIPTION

5.1 General

The combination LPU (LPC + SCM) and AMT constitutes a tool required for programming of LMS and SIU - in the long term an expected maintenance action, required when replacing broken units.

LPU also gives the possibility to make a functional test of an LMS or SIU.

The LPC comes with all cables required for connecting the PC, SCM, LMS and SIU and can be used for new as well as old versions of LMS and SIU. To connect the old version of SIU (591805 ver. 1.3) an adapter cable (594113) is required – to be ordered separately.

LPC supplies current (as a CCR) to the connected units (SCM, LMS, SIU) on the ”mini series circuit”. It also contains an isolation transformer for feeding the LMS and/or SIU plus a normal secondary load (45W / 6,6A) for the LMS and a control panel simulating external equipment for the SIU (e.g. a sensor).

The control buttons and the internal control board are designed to ease the operation of the LPC.
For full functionality a Windows-based PC running the maintenance tool AMT is required.

<u>When it comes to instructions for functional test or programming of LMS and SIU, please refer to the AMT User’s Guide</u>.

5.2 Specifications

Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Power Supply						
Supply voltage	Voltage selector: 120	V_{120}	100	**115**	120	V AC
	Voltage selector: 240	V_{240}	200	**230**	240	
Power frequency		f	50	**-**	60	Hz
Power consumption		P			200	W
Environment						
Humidity *(non condensing)*		RH	10	-	95	%
Ambient temperature, operation		T_A	-5	-	+55	°C
Ambient temperature, storage		T_{STG}	-20	-	+70	°C
Mechanical data						
Dimensions	Width *(rear)*	L_w		450		mm
	Width *(front)*	L_f		483		
	Depth *(excl. handles)*	L_d		375		
	Height *(excl. feet)*	L_h		133		
Weight	*Excl. cables*	m		16,5		Kg

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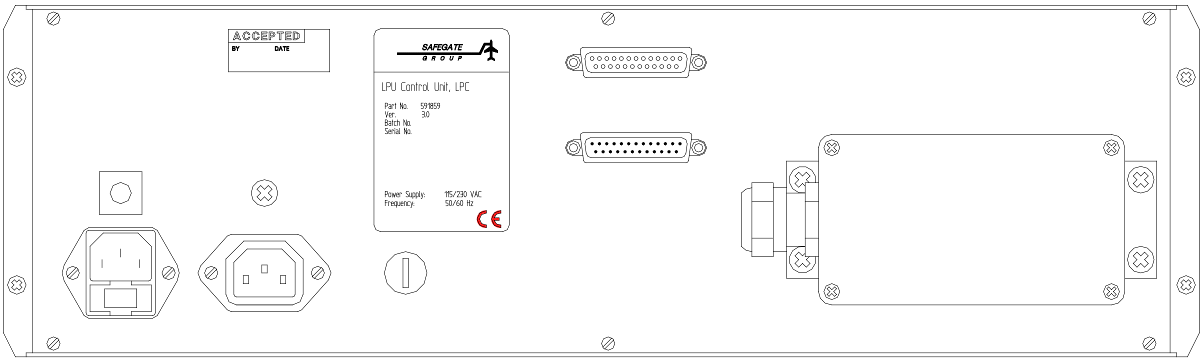
6 CONNECTIONS, CONTROL PANEL, ETC.

6.1 Rear



The **fused inlet** is located at the left. The fuse drawer allows for a spare fuse as well (T 2A @ 240V).
Just above, the **voltage selector** (120 / 240) is located, preset for 240 V at delivery.

Next to the inlet there's an **outlet** for power take-off for the SCM – this way, both LPC and SCM can be switched on/off by the same main switch. Then, there's a **fuse** (T 2A) for internal 24V supply.

In the upper D25-connector **outputs** (SIU supply voltage, SIU outputs) are found - for status reading using AMT.

In the lower D25-connector there are **inputs** for remote control of the LPC, at programming or test of LMS and SIU, using AMT.

The EMI-box at the right contains terminals for **connection of SCM** – used for communication (superimposing data) on the "local series circuit".

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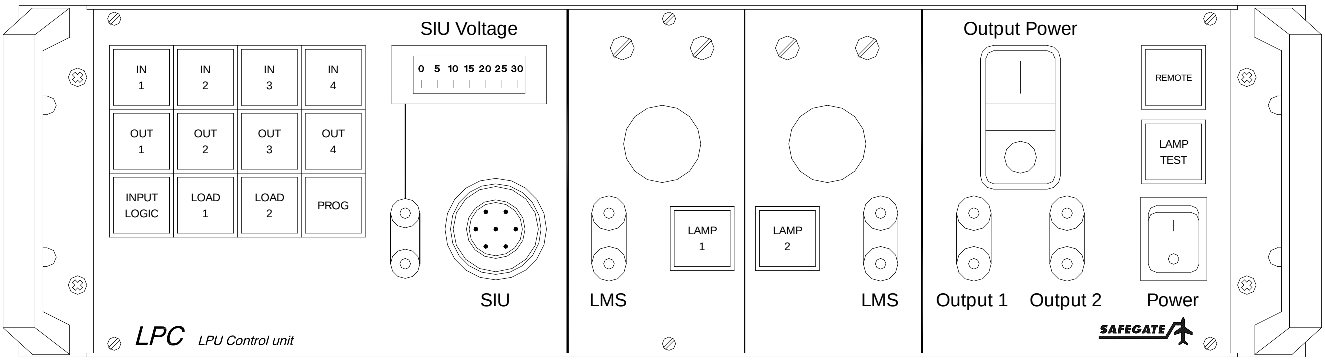
6.2 Front



The front is divided into 3 sections: **SIU - LMS - General functions**

6.2.1 SIU-section

The buttons IN1 IN2 IN3 IN4 set the input state for each of the SIU inputs.
Normal position for INPUT LOGIC, not pressed (indicator off), will turn on the indicators IN1 to IN4 when not pressed (out) and turn them off when pressed.
If INPUT LOGIC is pressed (indicator on), IN1 to IN4 indicators will instead be turned on as they are pressed.
Independent of INPUT LOGIC – if any of or both IN1 and IN2 are out, AMT displays: *SIU status= Detect* (the opposite can be set by SIU parameters).

OUT1 OUT2 OUT3 OUT4 indicate the state of each separate SIU output.
OUT4 is normally activated which means the SIU can supply voltage to external equipment , normally a sensor (MBD).
With the SIU connected to ***Output 1*** (or ***Output 2***), to the 7-pole *SIU*-connector and ***Output Power*** being switched on the ”***SIU Voltage***”-instrument shows the output voltage of the SIU (parameter selectable: 12/15/24 VDC).
An external V-meter may be connected to the panel mounted terminals.

Some inputs are interconnected to the outputs in the SIU. This makes OUT3 *activated simultaneously with* IN3, *the same applies for* OUT2 *and* IN4.

The load capacity of the SIU can be tested using LOAD 1 and LOAD 2.
For **12 V**: LOAD 1 + LOAD 2, **15V**: LOAD 1, **24V**: LOAD 2
The load test will show some decrease of the voltage (@ 15V: approx. 14V).

PROG button should only be used when prompted by AMT (SIU programming).

IN1 to IN4, LOAD 1, LOAD 2 and PROG can be remotely controlled (AMT).

6.2.2 LMS-section

The LMS-section (middle) is divided in two where each side has its connections for ***LMS*** to lamp, a push button that "disconnects" the lamp (when programming or at functional test). The LMS may be connected to any of the two lamps.

LAMP 1 and LAMP 2 connects the lamp when pressed (indicator on) and can be remotely controlled from AMT.

Lamp type: 45 W / 6,6 A (Pk30d)

6.2.3 General functions

The general control functions are located to the right. The ***Power*** button will switch on the LPC and supply voltage to the SCM (if connected as sketch below). The button will illuminate when activated.

The big button, ***Output Power***, will energize the connected LMS and/or SIU when pressing I – to turn off, press O. The button will illuminate when activated. ***Output Power*** will be interlocked only if the REMOTE button is out.

REMOTE must be pressed to enable the remote control of LPC from AMT.

The two (2) (current supply) outputs ***Output 1*** and ***Output 2*** are in series. LMS and/or SIU may be connected to any of these. An output not used must be bypassed by shortening the output with a Short Circuit Plug (supplied).

All indicator lamps can be tested by pressing the LAMP TEST button. This test does not include the 45W lamps.

The indicator lamps are back lighted to ease the use when using the LPC in a room with softened lights. The back light level is factory set but may be adjusted with an internal potentiometer.

6.3 Internal

ATTENTION: Be sure to disconnect the mains connection when opening the LPC for any adjustment.

By removing the top cover you'll find all internal components, most of them connected by plugs to the control board. On this board a trimmer (*V ADJ*) is located, for adjustment of the back light level. There are also three (3) switches that set the operating current (typ. 3,5-4,5 A) for the LMS/SIU and hence the intensity of the 45 W lamps

- **50-60 HZ** (S1): Pos. 60 will give a higher current and is intended to compensate for the impedance increase at 60 Hz.
- **27-30 V** (S2): refers to internal voltage at 50 Hz
- **S2-33 V** (S3): refers to internal voltage at 50 Hz
  Pos. S2 refers to 27 V or 30 V dep. on the S2 position

Factory settings (50Hz): S1=50, S2=30, S3=33.

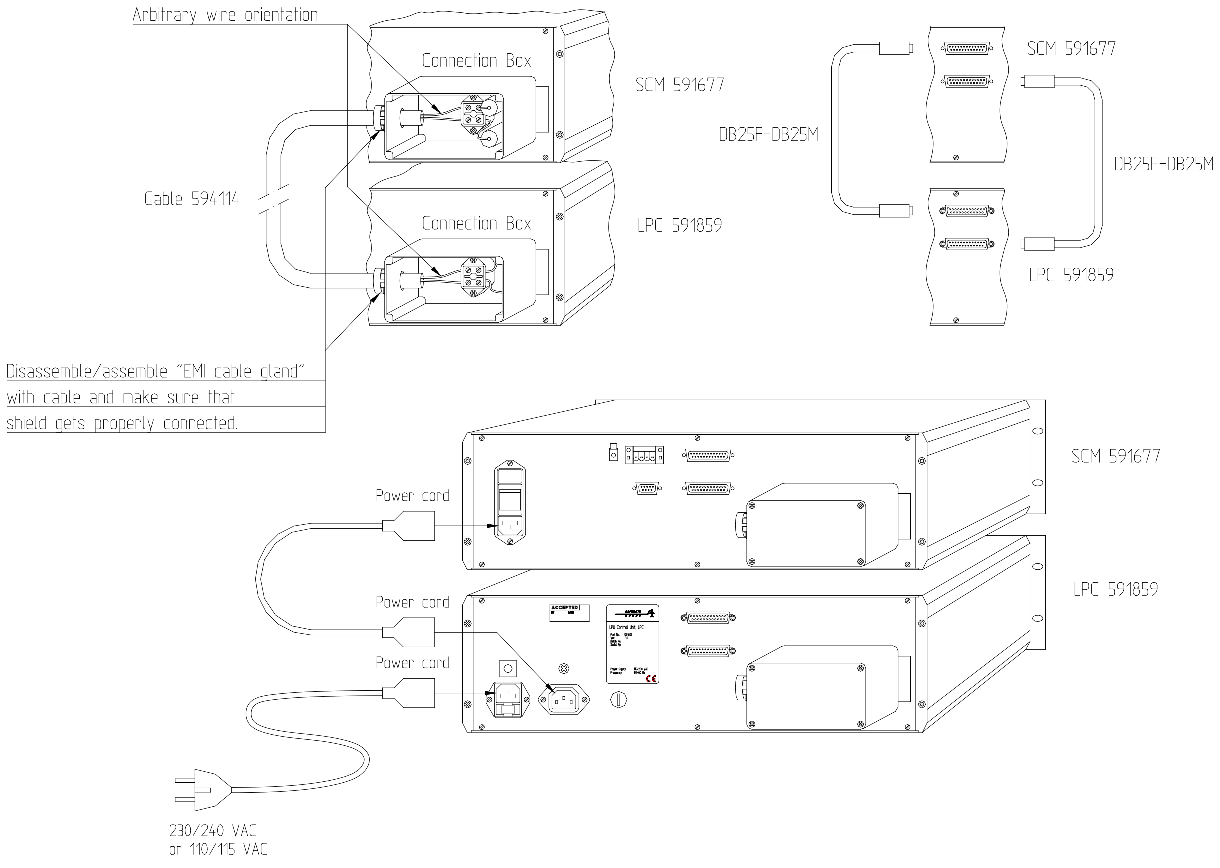
For 60 Hz, change S1 to position 60 to increase the intensity of the 45 W lamps.

7 SET UP

First check the voltage selector to be in the appropriate position: 120 or 240 V.

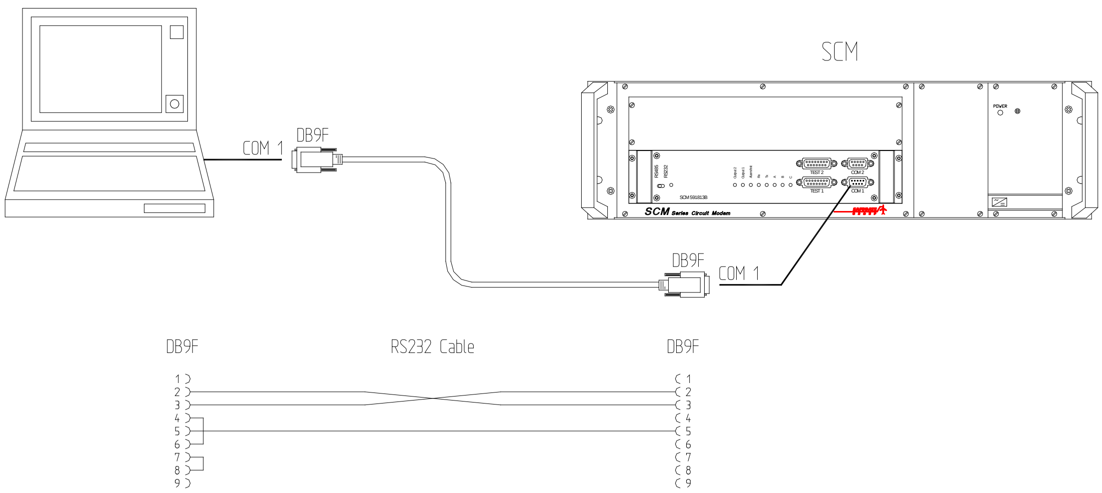
7.1 Connecting SCM

Connections between LPC and SCM are made at the rear, as shown in sketch below. All cables supplied with delivery.



7.2 Connecting PC

Use the supplied *RS-232 cable with LOAD/RESET (591869)* to connect as shown. The shorter cable end to be connected to the PC and the longer to the LPC – please refer to the marking on the LOAD/RESET-box!



7.3 Connecting LMS

Use the supplied cable *594115* to connect to ***Output 1*** or to ***Output 2***.

The Short Circuit Plug should be plugged into the output not in use (***Output 2*** or ***Output 1***) – the two outputs are connected in series and gives equal functionality.

Then use the cable *594116* to connect to ***LMS*** at LAMP 1 or to ***LMS*** at LAMP 2.

7.4 Connecting SIU

Use the cable *594115* to connect the SIU to ***Output 1*** (alt. ***Output 2***, as above) - remember the Short Circuit Plug!

For *SIU ver.2.0* (*591885*) use the cable *594112* (supplied) to connect to the *SIU*-connector on the LPC. To connect the old version of SIU (*591805*, ver.1.3) an adapter cable is required (*594113, to be ordered separately*).

8 MAINTENANCE

The LPC is designed for highest reliability during many years and will require only a minimum of maintenance.

Depending on the use some parts may wear out and be subject to replacement – most likely the plugs and connectors – avoid mechanical stress on these parts.

If not finding the appropriate spare part, please contact Safegate for advice.

Series Circuit Filter 591870-1

User's Guide

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CONTENTS

1 Revision History ... 3
2 Scope ... 3
3 Application ... 3
4 Abbreviations ... 3
5 References ... 3
6 Introduction ... 4
7 ASP Component Description ... 4
7.1 Electrical and Mechanical Specification ... 4
7.2 Functional Specification ... 4
8 Installation ... 4
8.1 Hardware Installation ... 4
9 Appendices ... 5
9.1 Appendix A ... 5
9.1.1 Electrical and Mechanical Characteristics ... 5
9.2 Appendix B ... 6
9.2.1 Maintenance ... 6
9.3 Appendix C ... 6
9.3.1 Troubleshooting ... 6

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1 REVISION HISTORY

Ver	Date	Remark	Author
1.0	020208	Copied from old format.	OH

2 SCOPE

This document describes the ASP System Component: Series Circuit Filter product number 591870-1.

3 APPLICATION

The User's Guide for the Series Circuit Filter covers specifications, installation, maintenance and troubleshooting of an SCF.

4 ABBREVIATIONS

ASP	Airfield Smart Power
SCF	Series Circuit Filter
SCM	Series Circuit Modem
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
CU	Concentrator Unit
CCR	Constant Current Regulator

5 REFERENCES

SG591890-3007	ASP System General Description

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6 INTRODUCTION

The SCF prevents the communication signals, superimposed on the series circuit by the SCM, to interfere with the CCR.

7 ASP COMPONENT DESCRIPTION

The SCF is an all passive device.

7.1 Electrical and Mechanical Specification

Refer to 9.1.1 for details.

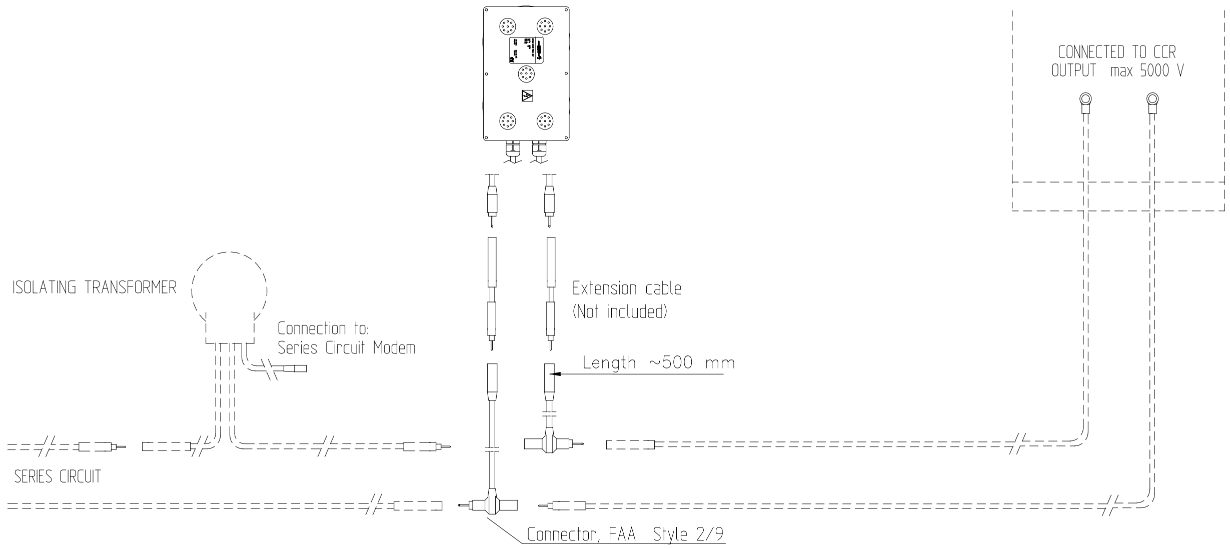
7.2 Functional Specification

The SCF virtually short circuits the communication signals superimposed on the series circuit by the SCM, and thus prevent them from interfering with the CCR. The SCF also prevents noise from the CCR from interfering with the ASP system communication.

8 INSTALLATION

8.1 Hardware Installation

The SCF is connected across the CCR output on the high voltage side of the series circuit. Preferable the SCF is positioned close to the CCR.



9 APPENDICES

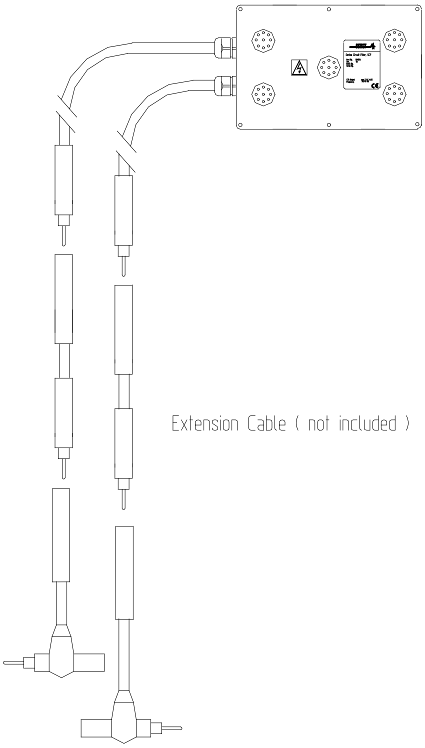
9.1 Appendix A

9.1.1 Electrical and Mechanical Characteristics

Unless differently noted, all maximum values are absolute maximum values.

Characteristics		Symbol	Min	Typ	Max	Unit
Electrical						
Voltage across series circuit terminals		V_{CCR}	-	-	5000	VAC
Environment						
Operating humidity range[1]		RH	10	-	+95	%
Operating temperature range		T_A	-5	-	+55	°C
Storage temperature range		T_S	-20	-	+70	°C
Mechanical data						
Dimensions	Width	W	-	**240**	_	Mm
	Depth	D	-	**160**	_	
	Height	H	-	**120**	_	
Weight			_	**3.5**	-	Kg

According to drawing *AT610063*.



[1] Non-condensing.

9.2 Appendix B

9.2.1 Maintenance

No special maintenance is required.

9.3 Appendix C

9.3.1 Troubleshooting

In case any trouble related to the SCF is encountered, always replaced the unit. Never open up or try to repair an SCF.

If the SCF fails the most apparent indication would be that the ASP communication quality on the circuit drops considerably leading to a sudden increase in false lamp status indications and/or communication drop-outs.

Since the design of the SCF uses only a few passive components, the reliability of the SCF is expected to be very high. Hence the most likely cause for trouble with the SCF is associated to its connection to the series circuit, i.e. mechanically oriented.

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SCM-Rack 591883
User's Guide

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INNEHÅLL

1 Revision History **3**
2 Scope **3**
3 Application **3**
4 Abbreviations **3**
5 References **4**
6 Introduction **4**
7 ASP component description **5**
7.1 General 5
7.2 Power supply 6
7.3 SCM-rack 6
7.3.1 Specifications 6
7.3.2 Connections - rear 7
7.3.3 Front and rear 8
7.4 Communication transformer 9
7.5 Backplane 10
7.5.1 LED-indications 10
7.5.2 RS-232/RS-485 alternative 11
7.5.3 RS-485 Terminations & "Failsafe" 11
7.5.4 Multidrop - RS-485 buses 12
7.5.5 G-bus: Master, Slaves 13
7.5.6 Digital I/Os 14
7.6 SCM-board 15
7.6.1 Front switch RS485/RS232 15
7.6.2 LED-indicators 15
7.6.3 Front connectors 16
7.6.4 Jumpers 16
7.6.5 Daughterboard 16
7.6.5.1 LED-indicators 16
7.6.5.2 Connectors 16
7.6.5.3 Jumpers 16
8 Installation **17**
8.1 Hardware installation 17
8.1.1 Power supply 17
8.1.2 SCM-rack 17
8.1.3 Communication transformer 17
8.1.4 SCM-board 18
8.1.4.1 Handling 18
8.1.4.2 Installation / replacement 18
8.1.5 Cooling 18
8.2 Software installation 18
8.2.1 SCM-board 18
9 Maintenance **19**
9.1 SCM 19
9.1.1 SCM-rack 19
9.1.1.1 Replacement 19
9.1.2 SCM-board 19
9.1.2.1 Hardware 19
9.1.2.2 Software 19
9.1.2.3 Parameters 20
9.1.2.4 Replacement 20
10 Troubleshooting **20**

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comments*
ÅP	2001-06-19	0.0	Draft created
ÅP	2001-10-24	0.1	Translated to swedish
ÅP	2002-03-15	1.0	Supplemented (spec/install/maint)
JF	2002-09-17	1.1	Translated to English
ÅP	2003-03-14	1.2	Supplemented (I/Os)

2 SCOPE

This document describes ***19” Rack for 8 SCM board*** from a user’s perspective. The description includes Backplane, SCM-board with daughterboard and external communication transformer.

3 APPLICATION

Specification, installation, set-up, maintenance and troubleshooting of *19” Rack for 8 SCM boards*.

4 ABBREVIATIONS

ASP	Airfield Smart Power
SCM	Series Circuit Modem
LPC	LMS/SIU Programming Control unit
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
CU	Concentrator Unit
CCR	Constant Current Regulator
AMT	ASP Maintenance Tool (maintenance software tool)

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5 REFERENCES

SG591883-3006	SCM Rack Configuration (template)
SG591891-3001	AMT User’s Guide
SG591890-3014	ASP System Preventive Maintenance.doc
SG591890-3004	ASP System – troubleshooting and maintenance

6 INTRODUCTION

The SCM constitutes the station-placed ”master”-unit for ”Power Line Communication” in an ASP-system. By superimposing signals, which represent data, on the current in a series circuit (normally 2.8-6.6 A), each SCM can communicate with LMS and SIU on the circuit to turn on/off lamps and monitor status for lamps and sensors.

This *19” Rack for 8 SCM boards, hereafter called **SCM-Rack***, enables a compact installation of up to 8 SCM-boards in a single rack. The SCM-rack provides the following functionalities, e.g.:

- *Selectable RS-232 or RS-485 interface for each SCM-board*
- *Support for two RS-485 channels (A/B), for each SCM-board*
- *Built in, selectable RS-485 termination & ”failsafe”-connection, for each SCM-board.*
- *Built in, selectable RS-485 buses (common for several cards)*
- *Common power supply – Selective/separate fuses for each SCM-board*
- *Support digital interface for controlling, e.g. for LPC*
- *Common data bus (G-bus), e.g. for synchronizing purposes*

The complete SCM-rack, including SCM-boards and daughterboards is **CE-approved**.

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7 ASP COMPONENT DESCRIPTION

7.1 General

Referring to *Figure 1* the complete SCM-rack can be described as following.

The *SCM-rack* is powered by an external 24VDC supply, that can be connected to the terminals on the backside of the rack. The rack has 8 slots for installation of up to 8 SCM-boards.

Each *SCM*-board requires an external *Communication transformer*. These are normally placed in same cabinet as the SCM-rack. The *Communication transformer* is connected to a standard *Isolation transformer* (200W / 6,6A).

The *Isolation transformer* is connected to the series circuit where ASP components (*LMS, SIU*) are installed for controlling and monitoring of lamps or sensors.

Each SCM-board is connected via respective RS485 (alt.RS232) connectors on the backside of the rack for communication with the CU.

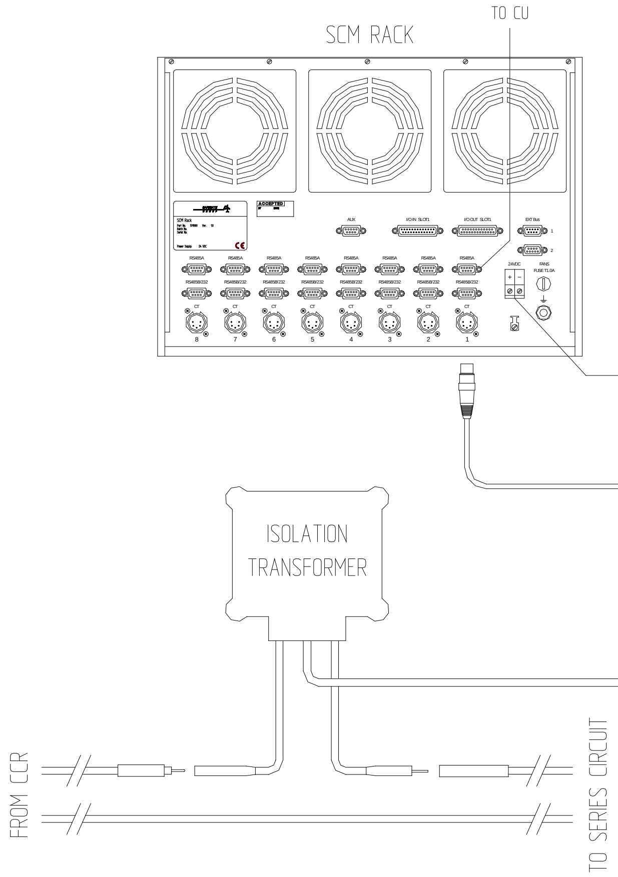

Figure 1. Principles for SCM-installation on a series circuit. Configuration with one circuit depicted.

7.2 Power supply

An external power supply unit, 24 VDC is used to power the rack. The power supply unit must comply with the electrical specifications of the SCM-rack. As all SCM do not transmit at exactly the same time (different phases etc) the peak current values are assumed not to coincide – as a rule of thumb max. RMS-value + 40% can be used to calculate the necessary peak current from the power supply.

Safegate can provide suitable power supply for one or more SCM-racks. Configurations with or without redundancy, with or without status signals, e.g. for PLC-supervision, can be supplied.

The external power supply is normally installed in the same cabinet as the SCM-rack(s). Separate fuses above each slot gives selective protection for malfunctions on the SCM board level.

Fuse	*Position*	*Description*
T 4.0A (5x20 mm)	Front	Individual fuse for each SCM board slot (1-8)
T 1.0A (5x20 mm)	Rear	Internal cooling fans (3)

7.3 SCM-rack

7.3.1 Specifications

Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Power supply						
Supply voltage		V	22	**24**	28	V DC
Current consumption RMS	1 SCM-board, transmit	I_1	0,5	-	2,1	A
	8 SCM-board, transmit	I_8	4	-	17	A
Current consumption peak	1 SCM-board, transmit	I_{1p}	2,4	-	3,7	A_{peak}
	8 SCM-board, transmit	I_{8p}	19	-	30	A_{peak}
Power losses	1 SCM-board	P_1	5	-	15	W
	8 SCM-board	P_8	40	-	120	W
Interface						
Series circuit via Communication transformer		P_S	-	200	-	W
		I_S	2,5	-	6,6	A
Environment						
Humidity *(non condensing)*		RH	10	-	95	%
Ambient temperature, operation		T_A	-5	-	+55	°C
Ambient temperature, storage		T_{STG}	-20	-	+70	°C
Mechanical data						
Dimensions	Width *(rear)*	L_w		442		mm
	Width *(front)*	L_f		483		
	Depth	L_d		350		
	Height	L_h		310		
Weight	Without SCM-boards	m_n		8,0		Kg
	8 SCM-boards	m_g		14,4		

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Note. Actual current consumption (RMS/peak) and heat power loss depends on transmit power (parameters set at commissioning). Values at 24VDC supply.

7.3.2 Connections - rear

On the rear, all connections required for installation and operation of the SCM-rack can be found. Each channel (1-8) is identified by the numbers below the connectors.

Connector (rear)	*Description*
RS485A	RS485, channel A (comm. with CU)
RS485B/232	RS485, channel B alternatively RS232 (comm. With CU). RS485 alt. RS232 is selected by jumpers on the backplane.
CT	Connection to Communication transformer
24 V DC	Connection to power supply
Earth bolt	Connection to protective earth - PE
AUX	*Not used*
I/O IN SLOT 1	*Digital / analog inputs (only slot 1)*
I/O OUT SLOT 1	*Digital outputs (only slot 1)*
EXT BUS (1 & 2)	*External connection (G-bus)*

7.3.3 Front and rear

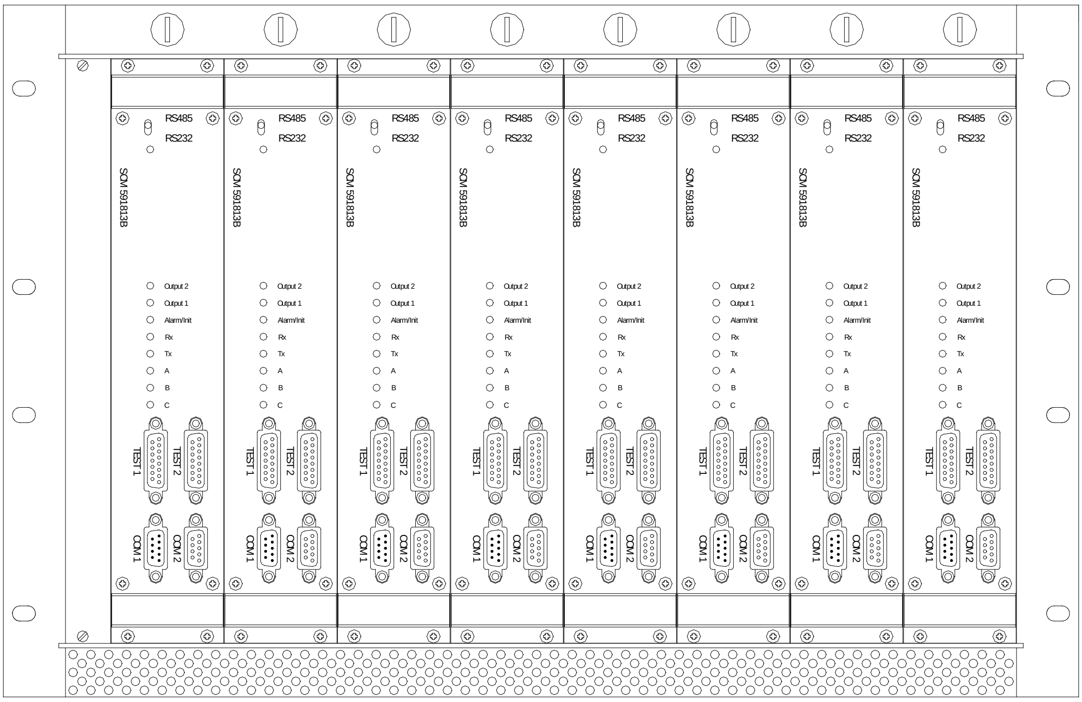

Figure 2. SCM-rack, front - to be equipped with desired number of SCM-boards (1-8). Not used slots should be covered by “blind” front panels.

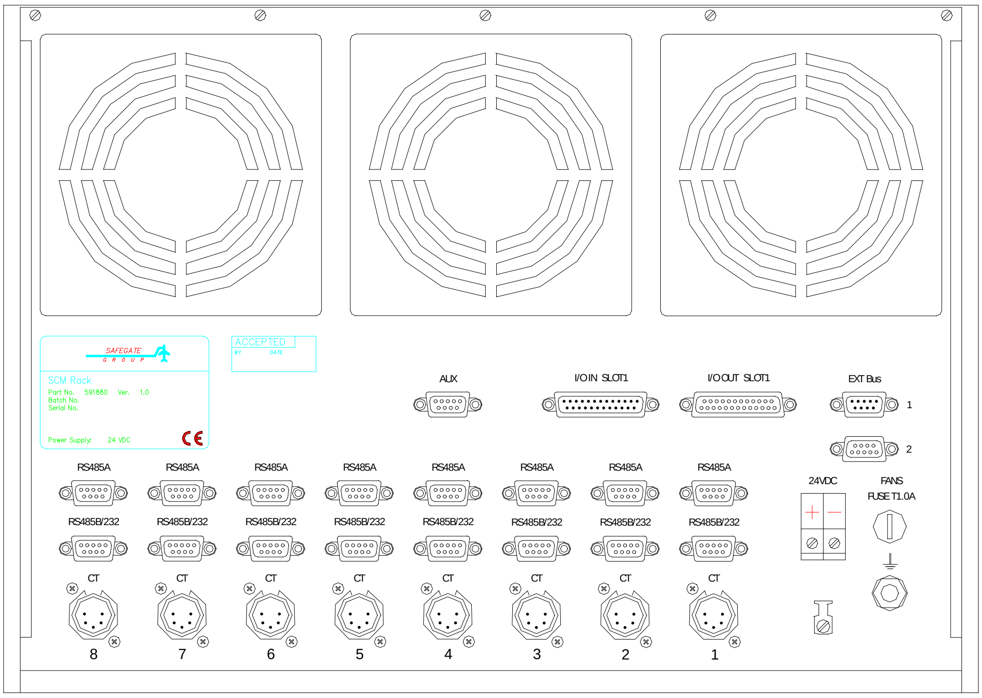

Figure 3. SCM-rack, rear.

7.4 Communication transformer

For each SCM-board, a *Communication transformer* is required. It adapts the series circuit's "6.6 A"-system to the transmit- and receive circuitry on the SCM-board. The communication signals will be superimposed on the series circuit current by this transformer.

It interfaces to the series circuit through a standard 200W isolation transformer.

Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Environment						
Humidity *(non condensing)*		RH	10	-	95	%
Ambient temperature, operation		T_A	-5	-	+55	°C
Ambient temperature, storage		T_{STG}	-20	-	+70	°C
Power losses		P_l	-	-	15	W
Mechanical data						
Dimensions	Width front	L_w		200		mm
	Depth	L_d		120		
	Height	L_h		90		
Weight			-	2,2	-	kg

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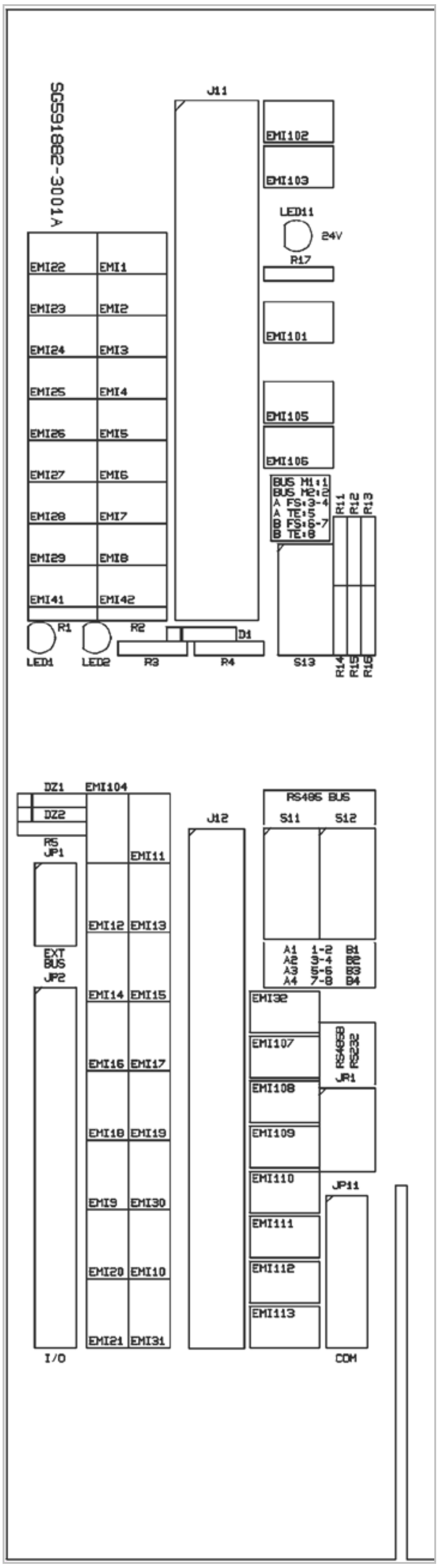
7.5 Backplane



The backplane accommodates 8 SCM-boards (*motherboard+daughterboard)* where the first position gives full functionality for the SCM-board, i.e. includes digital I/O for controlling purposes, e.g. LPC (which is used for LMS and SIU programming).

Besides communication on the series circuit with LMS and SIU, all slots provide:

- *Selectable RS-232 or RS-485 interface*
- *Two RS-485 channels (A/B)*
- *Selectable RS-485 terminations & "failsafe"-cfg.*
- *Selectable RS-485 data buses (common for several SCM-boards)*
- *Common data bus (G-bus), e.g. for synchronization*

Remark. Configuration/jumpers are set by Safegate personnel at commissioning – ref. to SG591883-3006

The first slot of the backplane is shown to the right =>

Slot 2 to 8 does not include the components to the left of the card connectors (J11, J12) but otherwise corresponding components.

7.5.1 LED-indications

The external 24 V voltage supply provides power to each slot, via the individual fuses (placed above each slot, on the front). On the upper half of the backplane 24 V is indicated according to following scheme:

Indicator	Indicates
LED11	24 V – slot 1
LED21	24 V – slot 2
LED31	24 V – slot 3
LED41	24 V – slot 4
LED51	24 V – slot 5
LED61	24 V – slot 6
LED71	24 V – slot 7
LED81	24 V – slot 8

To the left of slot 1 there are two indicators for the common data bus (G-bus):

Indicator	Indicates
LED1	G-bus, Master 1 active
LED2	G-bus, Master 2 active

7.5.2 RS-232/RS-485 alternative

Each slot has two serial communication ports. The first one is only for RS-485, while the other one is either for RS-485 or RS-232.

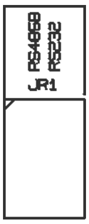
On the backplane of the SCM-rack there are 8 sets of COM-connectors, one set for each slot (*see figure 2*):

RS485A Channel A – only for RS-485

RS485B/232 Channel B – selectable as RS-485 or RS-232

The channel B mode is selected by the multi-jumpers JR1 to JR8, placed on the lower half of the backplane just above the ribbon cable connector.

SCM slot	*Jumper / Position:*	*Left*	*Right*
1	JR1	RS-485B	RS-232
2	JR2	RS-485B	RS-232
3	JR3	RS-485B	RS-232
4	JR4	RS-485B	RS-232
5	JR5	RS-485B	RS-232
6	JR6	RS-485B	RS-232
7	JR7	RS-485B	RS-232
8	JR8	RS-485B	RS-232



Factory setting: *RS-485B for all slots.*

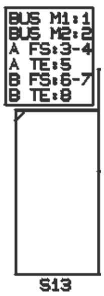
7.5.3 RS-485 Terminations & “Failsafe”

The *RS-485 standard* recommend a termination with the characteristic impedance (120 Ohm) at the last RS-485 unit in the line. <u>Only one RS-485 termination must exist for each RS-485 bus.</u>

To define the ”inactivity setting – Failsafe” for the bus, resistors be jumpered to the ”+ and –”-rails of the bus. If <u>Failsafe</u> is intended to be used, <u>this must only be set for one unit on the same RS-485 bus.</u>

RS-485 Termination and Failsafe is selected with DIL-switches S13 to S83 (corresponding to slot 1 to 8).

Function	*Switch position (S13 to S83)*
RS-485A Failsafe	3 & 4 ON
RS-485A Termination	5 ON
RS-485B Failsafe	6 & 7 ON
RS-485B Termination	8 ON



<u>ON</u> corresponds to the DIL-switch being <u>depressed on the right side</u>.

Factory settings: *All switches OFF (OPEN)*

<u>NO</u> Failsafe

<u>NO</u> Termination

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7.5.4 Multidrop - RS-485 buses

Using multidrop only one RS-485 connector is connected, for each bus, to the COM-ports on the rear of the rack. This reduces the amount of cabling.

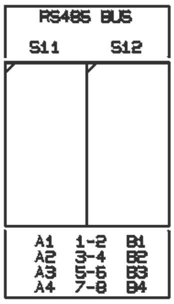
For each SCM-board 4 different buses can be selected for channel A and/or B. Each bus can include 1 to 8 (all) SCM-boards – it is however recommended to keep the number low because common bus means lower communication speed. A practical maximum is 3 SCM-boards per bus.

Multidrop should only be used for non time critical applications, such as lamp monitoring – not for lamp controlling where short response times should be given priority to.

It is possible to connect an SCM-board to different buses for A- respective B channel – normally both channels share the same bus.

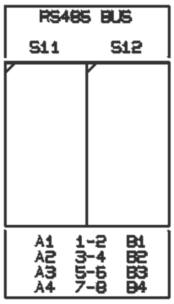
RS-485A bus options is done by the DIL-switches S11 to S81:

SCM slot	*DIL-switch*	*RS-485 **Bus A1***	*RS-485 **Bus A2***	*RS-485 **Bus A3***	*RS-485 **Bus A4***
1	S11	1+2 on	3+4 on	5+6 on	7+8 on
2	S21	1+2 on	3+4 on	5+6 on	7+8 on
3	S31	1+2 on	3+4 on	5+6 on	7+8 on
4	S41	1+2 on	3+4 on	5+6 on	7+8 on
5	S51	1+2 on	3+4 on	5+6 on	7+8 on
6	S61	1+2 on	3+4 on	5+6 on	7+8 on
7	S71	1+2 on	3+4 on	5+6 on	7+8 on
8	S81	1+2 on	3+4 on	5+6 on	7+8 on



RS-485B bus options is done by the DIL-switches S12 to S82:

SCM slot	*DIL-switch*	*RS-485 **Bus B1***	*RS-485 **Bus B2***	*RS-485 **Bus B3***	*RS-485 **Bus B4***
1	S12	1+2 on	3+4 on	5+6 on	7+8 on
2	S22	1+2 on	3+4 on	5+6 on	7+8 on
3	S32	1+2 on	3+4 on	5+6 on	7+8 on
4	S42	1+2 on	3+4 on	5+6 on	7+8 on
5	S52	1+2 on	3+4 on	5+6 on	7+8 on
6	S62	1+2 on	3+4 on	5+6 on	7+8 on
7	S72	1+2 on	3+4 on	5+6 on	7+8 on
8	S82	1+2 on	3+4 on	5+6 on	7+8 on



ON corresponds to the DIL-switch being depressed on the right side.

Factory settings: *All switches OFF – no “multidrop”.*

7.5.5 G-bus: Master, Slaves

Two separate buses, e.g. for synchronizing of activities on several SCM-boards, are located on the backplane. E.g. one of the SCM-boards can be selected as *Master* and will be synchronizing the other SCM-boards connected to the bus (*Slaves*).

There is also support for *multi-master mode* where several masters can co-exist on the same bus.

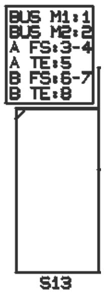
Masters (M1, M2) can be enabled individually or both at the same time, e.g. for redundancy reasons at failure of one of them.

All SCM-boards are connected to the two buses *G-bus 1* and *G-bus 2* and will (if configured so) therefore be *Slaves*.

The two *G-buses* can also be externally connected to other SCM-racks for synchronization. For this purpose there are two EXT.BUS-connectors on the backside of the SCM-rack.

DIL-switches S13 to S83 (corresponding to slot 1-8) decides which SCM will be selected as *Master* for each. *G-bus*:

Function	*Switch position (S13 to S83)*
Master M1	1 ON
Master M2	2 ON



ON corresponds to the DIL-switch being depressed on the right side.

Factory settings: *All switches=OFF (OPEN)*

No Master is selected

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7.5.6 Digital I/Os

The first slot provides full functionality for the SCM-board, including digital I/Os for controlling purposes, e.g. for LPC (which is used for programming of LMS and SIU). These digital I/Os are available on two separate connectors on the rear of the SCM-rack:

- I/O IN SLOT 1 *4 Digital / Analog (0-5 V, 8 bits ADC) inputs*
- I/O OUT SLOT 1 *8 Digital outputs, "Open-collector"-type*

The digital outputs are normally used for other tasks on the SCM-board. To use as separate controllable outputs, adapted software and/or parameters is required - same for reading the digital inputs.

I/O IN SLOT 1		I/O OUT SLOT 1	
D25M- pin	*Function*	*D25F- pin*	*Function*
1	Dig/Ana IN1 (0 ..+5V)	1	Dig. UT 1
2	Dig/Ana IN2 (0 ..+5V)	2	Dig. UT 2
3	Dig/Ana IN3 (0 ..+5V)	3	Dig. UT 3
4	Dig/Ana IN4 (0 ..+5V)	4	Dig. UT 4
5 – 8	Not used	5	Dig. UT 5
9 – 10	N/C	6	Dig. UT 6
11 – 13	+24V	7	Dig. UT 7
14 – 21	Buffered (3k3) +24V	8	Dig. UT 8
22 – 23	Analog ground	9	Relay 1 – NO
24 – 25	Digital ground	10	Relay 2 – NO
		11	+12V (isol.)
		12	GND (isol.)
		13	-12V (isol.)
		14 - 21	+24V
		22	Relay 1 – COM
		23	Relay 2 – COM
		24 - 25	N/C

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7.6 SCM-board

The name, which stands for Series Circuit Modem, implies that this board is used for communication on the series circuit. The SCM-board constitutes of a ”motherboard” and onto that mounted a “daughterboard”. A complete SCM-board is needed for each series circuit to communicate with LMS and/or SIU. The principles of communication is based on FSK (frequency shift), but adapted to series circuit systems where long cables as well as clusters of isolation transformers and (normally) thyristor noise must be mastered.

Available for communication with system above (normally CU):

- *Selectable RS-232 or RS-485 interface*
- *Two RS-485 channels (A/B)*
- *Selectable RS-485 termination*

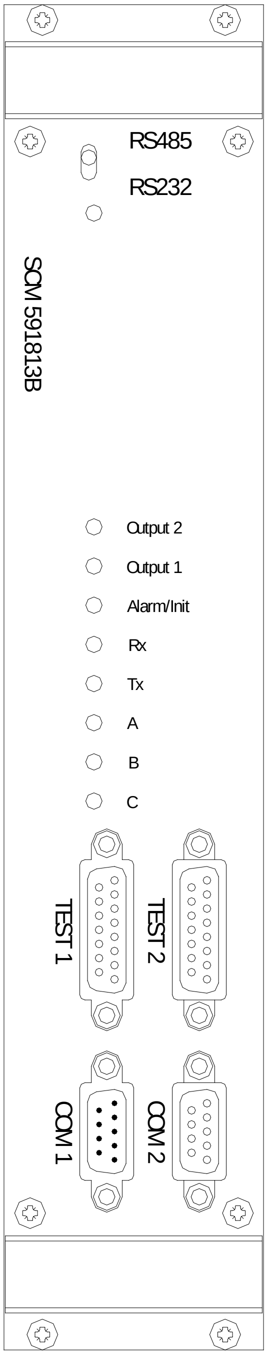
Described in 7.5.2 RS-232/RS-485 alternative,

and 7.5.3 RS-485 Termination & “Failsafe”

For e.g. synchronization of activities on several SCM-boards:

- *Common bus (G-bus)*

Described in 7.5.5 G-bus: Master, Slaves



7.6.1 Front switch RS485/RS232

The position of the front switch selects RS-232 or RS-485 as communication interface to host system.

- *For CU, RS-485 is normally selected*
- *For maintenance, with e.g. AMT and laptop-PC, RS-232 is normally selected*

RS-232 is indicated by the yellow LED next to the switch.

7.6.2 LED-indicators

The indicators are software- and parameter controlled. At normal operation the following applies:

Text	Color	Indicates
Output 2	Green	Not used
Output 1	Green	No current in series circuit (below threshold value)
Alarm/Init	Red	Summary alarm e.g. initiation at CCR power on, and after SCM power on.
Rx	Green	Receives data from CU (or AMT/laptop)
Tx	Yellow	Transmits data from CU (or AMT/laptop)
A	Yellow	Indicates channel A (RS-485A) available as communication channel to CU
B	Yellow	Indicates channel B (RS-485B) available as communication channel to CU
C	Green	SCM transmits status question/order to LMS/SIU

7.6.3 Front connectors

The four connectors on the SCM-board front has the following functionality

Connector	*Description*
COM 1	RS232-LOAD-RESET: For connection of maintenance-PC (AMT software). Special cable (Part no. 591869) is required for external LOAD/RESET
COM 2	RS232 connection for advanced test/maintenance of the daughterboard
TEST 1	Test points - motherboard. For factory tests
TEST 2	Test points - daughterboard. For factory tests and advanced commissioning

Remark. Advanced maintenance and commissioning is only performed by or with support from Safegate personnel.

7.6.4 Jumpers

There are a number of jumpers on the SCM-board which must be correctly configured to ensure correct operation.

Jumper	*Position / Function*	*Normal pos.*
SL1 (Transmit power)	**I n= Operative**, Out = Test	In
SL2 (Receive-mode)	*In = Operativt, Out = Test*	*Not used*
SL3 (Receiver gain)	*In = High , Out = Low*	*Not used*
SL4 (Pgm load mode)	In = Progr.load.,**Out = Operative**	Out
SL5 (Pgm load, ext. control)	**In = Available**, Out = Not available	In
SL6 (Reset, ext. control)	**In = Available**, Out = Not available	In

7.6.5 Daughterboard

A daughterboard, equipped with a digital signal processor (DSP) is mounted on the SCM-board. This provides better performance and easier commissioning.

7.6.5.1 LED-indicators

There are some green LEDs indicating internal voltage supply (+5, -5, +3,3 V) on the board.

Additionally 2 indicators (INC, U/D) exist on the board – these are used for debugging purposes and are of no interest to the user.

7.6.5.2 Connectors

Besides the front connectors (COM 2, TEST 2) there are two connectors for connection with the motherboard, and one for factory programming.

7.6.5.3 Jumpers

If existing, the jumpers on the daughterboard should be left in normal positions. Later revisions may not include these jumpers.

Jumper	*Position / Function*	*Normal pos.*
JP1 (MOD B)	In = Test/Progr,**Out=Operative**	Out
JP2 (MOD A)	**In=Operative**, Out= Test/Progr.	In

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8 INSTALLATION

8.1 Hardware installation

All installation must be carried out with power disconnected and according to supplied instructions. Normally SCM-racks, communication transformers and power supply unit will be installed in the same cabinet. A typical “2m”-cabinet (W=80, D=80) will accommodate up to 3 SCM-racks, 24 communication transformers and power supply unit, to serve 24 series circuits with ASP communication.

Safegate offers standard solutions for the mounting and can deliver factory built cabinets.

8.1.1 Power supply

Follow the manufacturer’s recommendations regarding mounting, cooling, protection etc. To get selective protection at failure it is recommended that, if several SCM-racks are using same power supply, each SCM-rack is protected by an individual fuse. This will also ease replacement of a defect SCM-rack. Safegate can provide suitable power supply for one ore more SCM-racks.

All connections must be made according to supplied connection diagrams.

8.1.2 SCM-rack

The SCM-rack should be mounted giving access to its front and back. All connections are made on the back. A cabinet with a removable back cover or a back door or a cabinet with a swing frame can be used. The latter solution allows installation towards a wall.

All connections must be made according to supplied connection diagrams.

8.1.3 Communication transformer

These will normally be placed in same cabinet as the SCM-racks. If installed outside the cabinet, the cable length should not exceed 10m between SCM-rack and communication transformer. Shielded cable, connectors and cable type corresponding to ”cabinet-internal” wirings should be used (Part no. 594102).

The communication transformer is then connected to a standard *Isolation transformer* (200W/6.6A). The cable length between them should not exceed 40m. Shielded cable according to supplied documentation should be used.

The communication transformers emit some heat (see chapter *7.4*) and should therefore be mounted with good ventilation.

All connections must be made according to supplied connection diagrams.

Contact Safegate for information about suitable cable types.

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8.1.4 SCM-board

8.1.4.1 Handling

The SCM-board includes components sensitive to ESD. The board must therefore be handled carefully. Before it is removed from its packing (ESD protective bag), touch a grounded object (the SCM-rack or the cabinet), to discharge yourself! Best is to use an ESD wrist-strap connected to ground. Hold the SCM-board in front/edges and avoid touching the components on the PCB.

8.1.4.2 Installation / replacement

Each slot in the SCM-rack is individually fused. When installing or replacing an SCM-board, the power should be interrupted to the associated slot. In the meantime remaining SCM-boards can stay in operation, which will minimize the operational consequences.

First remove the fuse (T 4,0 A) above the associated slot before the SCM-board is removed or inserted.

The SCM-board is mounted with four screws in the corners of its front panel. Carefully remove the old board from its slot and put it in a safe place (ESD protective bag).

When replacing a board, make sure that all **jumpers are mounted correctly** on the motherboard as well as on the daughterboard. Compare with the old SCM-board or see 7.6.4 *Jumpers* and 7.6.5.3 *Jumpers*.

Insert and mount the board, then **restore the fuse** to power up the board again.

See further *Maintenance – SCM-board* (below), regarding software parameter configurations etc.

8.1.5 Cooling

The cabinet must not be ”closed” but must have ventilation for both incoming and outgoing air. Forced ventilation (evacuating cabinet fan) is recommended, especially in fully equipped cabinets.

For the cooling of the SCM-rack, the airflow must not be blocked – the intake is at the lower position of the front. The exhaust is on the back.

The communication transformers must also be mounted to allow good circulation of air (see above)

8.2 Software installation

Only the SCM-board (motherboard and daughterboard) contains software.

8.2.1 SCM-board

At the system commissioning, Safegate will see to that correct software is installed. The user should not need to install any software

See also chapter *Maintenance – SCM-board*, below.

9 MAINTENANCE

For preventive maintenance instructions – see "ASP System Preventive Maintenance", document SG591890-3014.

For general maintenance instructions - see "ASP System – Troubleshooting and maintenance", document SG591890-3004.

9.1 SCM

9.1.1 SCM-rack

The SCM-rack does not require any regularly maintenance, but an overall checking of the operation, e.g. the function of the internal fans, is recommended once in a while. The fuse for the fans is located on the back of the rack.

9.1.1.1 Replacement

At replacement of the SCM-rack, the power supply must be turned off and be disconnected. Consult installation drawings to see how.

All SCM-boards must be removed from the old rack – keep track of which slot they are placed in so that they are put back in the correct slot in the new rack (labels makes it easier). See also chapter *SCM-board - Installation / replacement* (above)

Disconnect all cables on the rear of the rack – keep track of where to reconnect each connector.

Dismount the old rack, mount the new rack in the cabinet, reconnect all cables.

The backplane of the SCM-rack has a large number of DIP-switches and jumpers, Compare settings with the old rack and ensure that all switches/jumpers are at same positions as in the old rack - you could also refer to the as-built document "SCM Rack Configuration". After that, remount the SCM-boards.

Finally, reconnect power supply and check that operation is OK.

9.1.2 SCM-board

The SCM-board does normally not require any regularly maintenance. Replacement is only needed at a board failure.

9.1.2.1 Hardware

For replacement of SCM-board, see chapter *SCM-board - Installation / replacement* (above).

9.1.2.2 Software

Normally, all SCM-boards in the system delivery have the same software installed (motherboard and daughterboard). An exception could be if a single board has been replaced.

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9.1.2.3 Parameters

Each SCM-board contains a set of parameters unique for each circuit. The parameters typically depends on total load (number of LMS, SIU och isolation transformers) on the circuit, circuit length, the distribution of the load, noise environment, etc. These parameters will be optimized by Safegate personnel at commissioning and must be preserved to ensure correct operation.

9.1.2.4 Replacement

At replacement of SCM-board, the new board must have correct software and parameters installed. How this is checked and how to download software and parameters - see document *SG591891-3001 - User's Guide AMT*, chapter *SCM Maintenance*.

10 TROUBLESHOOTING

According to "ASP System – troubleshooting and maintenance" document SG591890-3004.

As knowledge of the complete ASP-system is a prerequisite for effective troubleshooting and correcting malfunctions or failures, it is **recommended that maintenance personnel have attended the ASP training** that Safegate offers.

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SIU 591885

User's Guide

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CONTENTS

1 Revision History 3
2 Scope 3
3 Application 3
4 Abbreviations 3
5 References 3
6 Introduction 3
7 Compatibility 4
8 Characteristics 4
8.1 Physical Appearance 5
8.2 Installation 5
8.3 Inputs and Outputs 5
8.3.1 Inputs 5
8.3.1.1 Input Scanning 5
8.3.1.2 Input Configuration 6
8.3.1.3 Input Filtering 6
8.3.2 Outputs 6
8.3.2.1 Power Output Characteristics 7
8.3.2.2 Protecting the Outputs 7
8.3.2.3 Output Configuration 7
8.3.3 Shared I/O 8
8.4 Sensor Test Function 8
8.5 Direction Detection 8
8.6 Programming 8
9 Appendices 8
9.1 Appendix A 8
9.1.1 I/O-Connector Configuration 8
9.1.2 Cable Recommendations 9
9.2 Appendix B 9
9.2.1 Configuring Sensor Test for SG596530 9
9.3 Appendix C 10
9.3.1 Troubleshooting 10
9.4 Appendix D 10
9.4.1 Electrical and Mechanical Characteristics 10

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comment*
OH	2002-01-29	1.0	Document created.
OH	2003-03-31	1.1	Added details to installation section.

2 SCOPE

This document describes the *Sensor Interface Unit* (SIU) and summarizes its characteristics.

3 APPLICATION

This document applies to SIU 591885 with firmware version 2.0.

4 ABBREVIATIONS

SIU	Sensor Interface Unit
LMS	Light Monitor and Switch Unit
SFU	Signal Filter Unit
SCM	Series Circuit Modem
MBD	Microwave Barrier Detector
AMT	ASP Maintenance Tool

5 REFERENCES

SG591891-3001	AMT User's Guide

6 INTRODUCTION

In an ASP®-System the sensor interface unit (SIU) constitutes one of the basic field-installed components. The LMS is another such component.

An SIU is designed to control, monitor and power, up to four external sensors or various other types of equipment that support control and feedback through digital I/O.

The SIU is addressed by the SCM to, on command; switch *on* or *off* anyone of its four outputs. The SCM receives a back-indication from the SIU that reflects the current input status, e.g. *detection* or *no-detection*, *sensor status* etc. depending on configuration and application.

In addition several higher level functions like direction detection and sensor testing are supported.

To what extent all available features in an ASP System in general and in an SIU in particular, are used in a specific application depends on the application itself. Hence it's possible that not all features mentioned in this document are used in a particular application.

7 COMPATIBILITY

The SIU 591885 is backwards compatible with the SIU 591805 both in terms of handlings and functionality. This implies that an SIU 591885 can be used (transparently) as a spare in a system originally equipped with the SIU 591805.

Mechanically the SIU 591885 is different from the SIU 591805. The former has four connectors for external equipment while the latter only has one. Furthermore, the connector type is not the same for the two different types of SIU.

Equipment formerly connected to an SIU 591805 shall be connected to an SIU 591885 using an adaptor cable (594110).

8 CHARACTERISTICS

The (application specific) functional properties of an SIU are controlled by a set of parameters downloaded to the unit prior to installation. These parameters may also be modified after installation. The mechanism used to download parameters to an SIU in the field uses the same power line communication channel used for commands from the SCM and status back indication from the SIU (see also 8.6).

This document does not contain any detailed information on specific parameters since all necessary information for programming an SIU being a part of an ASP System, is contained in a database, unique to each system. If an SIU needs to be replaced parameters are fetched from the database and downloaded to the unit.

Below a summary of the most prominent features of an SIU is found, including mechanical and electrical characteristics.

8.1 Physical Appearance

The SIU is equipped with four connectors for sensors and other equipment in addition to the series circuit interface connector, which connects to the secondary of a standard isolation transformer (see 9.4.1 for details).

The four connectors for sensor interfacing are identical with reference to pin-configuration (see 9.1.1 for details). Consequently the connectors are not marked for identification.

8.2 Installation

Connect the SIU to the secondary of an isolation transformer and to the external equipment to control and monitor (see 9.1 for details on connector pin configuration and cable recommendations).

Special attention should be paid when connecting external cables to the SIU inputs:

- Make sure that all connectors are clean and properly assembled before connecting them to the SIU. The connector insert must be perpendicular to the connector surface, if not so the connector needs to be disassembled, then reassembled and checked before connected to the SIU.
- Tighten the locking ring by hand (no tools must be used). Make sure that the threads mate properly before applying force. Failure to comply with this requirement may lead to permanent damage to the connector.

- SIU connectors not used must be equipped with sealing caps. Make sure that they are properly tightened. Replace caps not fully functional.
- When an external connector is connected to the SIU, there will be two sealing caps no longer used. Put them together and tighten them to avoid dirt interfering with future use.

8.3 Inputs and Outputs

Refer to 9.1 for information on connector layout and pin numbers.

8.3.1 Inputs

The SIU supports four separate inputs of which two are shared with outputs. They are: IN1[1], IN2, IN3 (shared with OUT3) and IN4 (shared with OUT2). Requirement on device supplying input signal: current sinking, NPN or contact closure to ground (SIU Common terminal).

8.3.1.1 Input Scanning

The SIU scans its inputs once every half cycle of the mains frequency, i.e. with a frequency of 100Hz @ 50Hz and 120Hz @ 60Hz. The physical state of the signal for every individual input is filtered by the SIU and the result is denoted input status. Input status can be either passive or active.

[1] In the documentation for SIU 591805 IN1 and IN2 are denoted DET1 and DET2 respectively while IN3 and IN4 are called STATUS1 and STATUS2.

8.3.1.2 Input Configuration

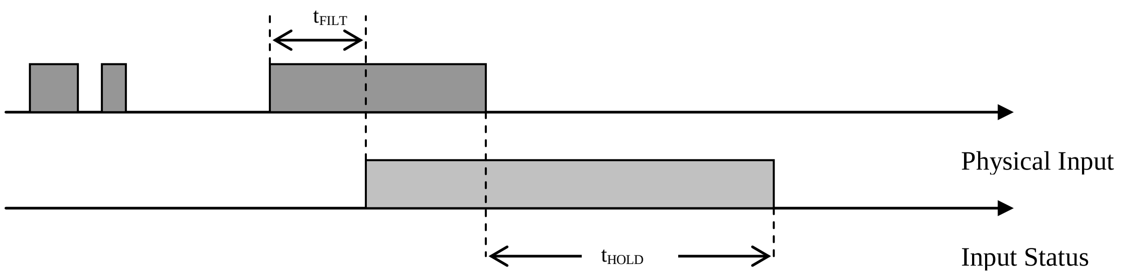
The relation between the physical input signal and the input status in terms of passive or active is configurable and denoted *input logic*. This implies that depending on configuration, the SIU will either match a physical contact closure to ground to physical input status passive (logic 0) or physical input status active (logic 1). The table below list all possible combinations.

Input Logic	Physical Input	Status	Logic Equivalent
0	Floating	Passive	0
0	Shorted to GND	Active	1
1	Floating	Active	1
1	Shorted to GND	Passive	0

Recommended input logic = 1, i.e. an input not connected or floating is active and hence an alarm can be generated if a cable is cut.

8.3.1.3 Input Filtering

The input filter consists of a digital low-pass filter, which is designed to filter out glitches and de-bounce the input signal. Basically the filter requires the input signal change from passive to active to last for a certain period of time referred to as the *filter time* (t_{FILT} in the figure below).



In addition the input status can be configured to last beyond the point in time where the physical input signal has disappeared.

8.3.2 Outputs

The SIU supports four separate outputs of which two are shared with inputs and one is a programmable power output. They are: OUT1, OUT2 (shared with IN4), OUT3 (shared with IN3) and OUT4 (power output).

OUT1, OUT2 and OUT3 are open collector outputs, which sink a maximum of 100mA per output, at a maximum voltage of 26VDC.

OUT4 is a programmable voltage output, 12VDC at I_{max}= 625mA, 15VDC at I_{max} = 500mA or 24VDC at I_{max} = 300mA.

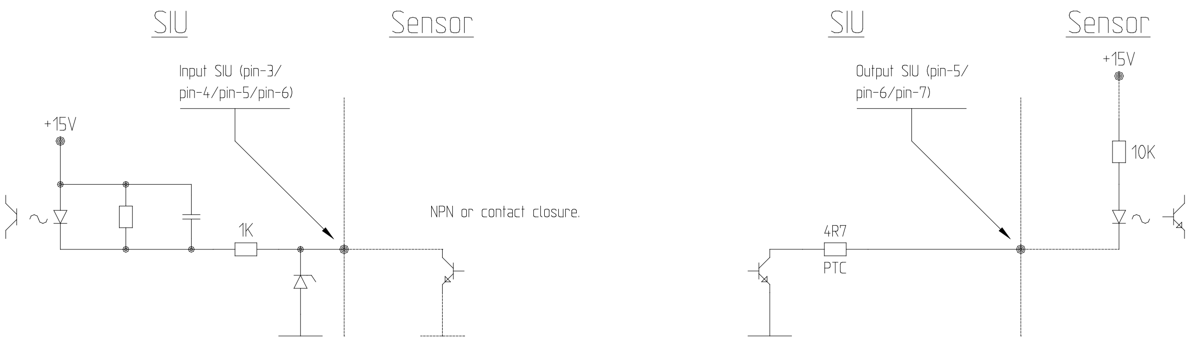


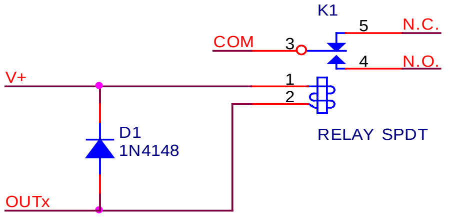
Figure 1 Input/Output skeleton drawing.

8.3.2.1 Power Output Characteristics

The SIU hardware supports voltage fold back on OUT4. In other words, output voltage will decrease as current increases. Software monitors the voltage level continuously and if it falls below a certain threshold, which depends on the programmed output voltage level, OUT4 will be turned off in order to protect the output (short circuit protection). When the SIU has detected excessive current drain for OUT4, the output will be turned back on for 100ms once every second until the current drain is within limits again in which case OUT4 will be left on.

8.3.2.2 Protecting the Outputs

When an output is driving a relay, a free-wheel diode (D1 in the figure below, 1N4148 is an example) must be added across the relay coil for protection of the output. Note that V+ in the figure may be either OUT4 or a voltage external to the SIU (in the latter case the SIU Common terminal shall be connected to the ground reference for V+). The maximum V+ voltage allowed is 26VDC.



8.3.2.3 Output Configuration

Each output can be individually controlled by command from the SCM.

In addition each output can be independently configured to either accept or discard commands from host. This implies that to control an output remotely it must have an address assigned for control and be configured for control.

The SIU supports a feature where an output turned on by command from host is automatically turned off after a certain period of time.

If communication between the SIU and the SCM is interrupted or lost the SIU is programmed to either leave the outputs unchanged or set them to a state corresponding to the power on state defined. This mechanism is referred to as *Safe State*.

OUT1, OUT2 and OUT3 are said to be active or on when sinking current and passive or off when floating while OUT4 is active or on when supplying power to the load and passive or off when not.

8.3.3 Shared I/O

Inputs and outputs sharing the same pin require the one to be used exclusively of the other. *Note* that this applies to the SIU as a unit.

8.4 Sensor Test Function

The SIU supports a function, which can be configured to periodically (down to as often as once every 10 seconds) test a sensor. The basic operation is that the SIU turns of the transmitter side of the sensor while monitoring the receiver side for detection. If the receiver side does not detect the missing transmitter signal it indicates a sensor failure, which the SIU will report.

While the sensor test is in progress live sensor status is suppressed which implies that the sensor function will be unavailable throughout the duration of the test sequence. Typically the sensor test sequence takes less than one second to complete.

The following requirements must be met for correct operation of the sensor test function:

- The sensor used must have an input, which allows the SIU to turn off the transmitter side.
- Both the receiver and the transmitter in a sensor pair must be connected to the same SIU.

The Safegate MBD (596530) meets these requirements.

8.5 Direction Detection

The SIU can be configured to evaluate signals from several sensors thereby enabling detection of direction of movement.

8.6 Programming

The procedure through which the SIU in configured is referred to as *programming* or parameter download. SIU programming is described more in detail in the *AMT User´s Guide* (see 5).

9 APPENDICES

9.1 Appendix A

9.1.1 I/O-Connector Configuration

The table below refers to all four I/O-connectors available on the SIU.

Pin#	Name	Description
1	OUT4	Output 4, power output
2	Common	Common reference to all signals.
3	IN1	Input 1, in compatibility mode referred to as DET1.
4	IN2	Input 2, in compatibility mode referred to as DET2.
5	IN3/OUT3	Combined Input 3 and Output 3. In compatibility mode IN3 is referred to as STATUS1.
6	IN4/OUT2	Combined Input 4 and Output 2. In compatibility mode IN4 is referred to as STATUS2.
7	OUT1	Output 1

9.1.2 Cable Recommendations

Select cable cross-section for connecting the SIU to the sensor or any other equipment, according to the table below:

Max Distance [m]	Cross Section [mm^2]	Comment
100	0.5	Provided 1V voltage drop is acceptable for the cable itself and the sensor current drain is less than 150 mA.
150	0.75	
200	1.0	
300	1.5	

For any other combination of cable length and current drain use the following formula to calculate appropriate cross-section for the cable:

$A = (0.0344 \times I_{DRAIN} \times L) / V_{DROP}$, where A is the cross-section [mm^2], I is the current [A], L is the distance between the SIU and the equipment (sensor) to connect [m] and V_{DROP} is the voltage drop [V] across the cable itself.

9.2 Appendix B

9.2.1 Configuring Sensor Test for SG596530

The checklist below assumes that a single sensor (including receiver and transmitter) is connected to the same SIU.

Step	Action	Comment
1	Connect a 500Ω resistor between power supply (+) and TEST-terminal in transmitter.	See Figure 2.
2	Connect TEST-terminal in transmitter to SIU OUT1 (pin 7 in connector).	See Figure 2.
3	Connect power supply terminals in transmitter to SIU OUT4 (+) and Common (-) (pins 1 and 2 in connector).	See Figure 2.
4	Connect a wire between power supply (-) and ALARM RELAY COM-terminal in receiver.	See Figure 2.
5	Connect ALARM RELAY NC-terminal in receiver to SIU IN1 (pin 3 in connector).	See Figure 2.
6	Connect power supply terminals in receiver to SIU OUT4 (+) and Common (-) (pins 1 and 2 in connector).	See Figure 2.
7	Make sure that the HOLD-potentiometer in the receiver is adjusted for minimal hold	Turn potentiometer counter clock wise to stop position for minimal hold time.

Step	Action	Comment
	time (0.5s) and that the NORMAL/LATCH-jumper is set for NORMAL.	

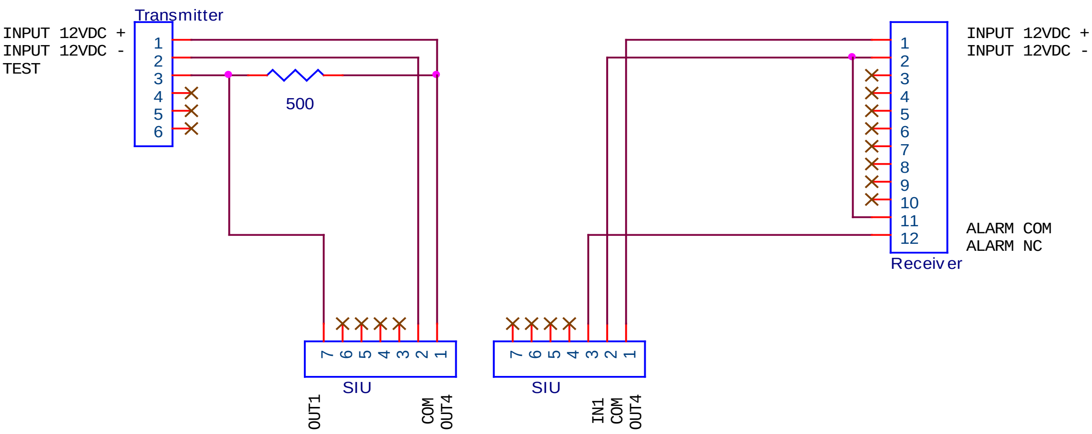


Figure 2 Interfacing SG596530 to SIU with Sensor Test support.

9.3 Appendix C

9.3.1 Troubleshooting

The most common cause for SIU malfunction is erroneous installation. It is recommended to always start by verifying the connections, both to the series circuit and to the external equipment (sensor). Make sure to check cables and connectors thoroughly (see 8.2 and 9.1.1).

Proceed with verifying that the SIU power output (OUT4) provides the programmed output voltage. Check both with and without the sensor(s) connected. If the voltage level fluctuates between the programmed level and zero this is a good indicator of a possible problem in the cable connecting for example a sensor to the SIU or an over load condition.

If the cause for failure has not been identified by now it is not unlikely that either a sensor failure or an SIU failure is the cause of the problem. In this case start by verifying the sensor function. If the sensor checks out okay, replace the SIU.

9.4 Appendix D

9.4.1 Electrical and Mechanical Characteristics

Unless differently noted, all maximum values are absolute maximum values. All voltages are with reference to the SIU Common, pin2.

Characteristic	Symbol	Min	Typ	Max	Unit
Series Circuit					
Supply current from series circuit (50/60Hz)	I_{SUPPLY}	2.5	-	7.1[2] 8.2[3]	A_{RMS}

[2] In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems).

Characteristic		Symbol	Min	Typ	Max	Unit
Peak input voltage series circuit terminals		V_{SUPPLY}	-	-	40	VAC
Isolation voltage		V_{ISO}	1500	-	-	VAC
Interface isolation transformer rating		P_{IT}	65	**100**	200	W
I/O						
Output power OUT4		P_{OUT4}	0	-	7.5	W
Voltage OUT4 (Min values apply to full load and max values to zero load. Note that load includes cable and connected equipment.)	12VDC	V_{OUT4}	10.5	**12**	12.5	VDC
	15VDC		13.8	**15**	15.6	
	24VDC		23.0	**24**	25.0	
Current drain OUT4	12VDC	I_{OUT4}	0	-	625	mA
	15VDC				500	
	24VDC				300	
Current drain (sink) per output excluding OUT4		I_S	0	-	100	mA
Input voltage IN1, IN2, IN3/OUT3, IN4/OUT2, OUT1, OUT4		V_{IN}	0	-	26	VDC
Input impedance IN1, IN2, IN3 and IN4 all to OUT4		Z_{IN}	1000	-	-	Ω
Environment						
Operating humidity range		RH	0	-	100	%
Operating temperature range		T_A	-30	-	+65	°C
Storage temperature range		T_{STG}	-30	-	+100	°C
Encapsulation class		IP68				
Dimensions excluding cables	Width	L_W	-	**165**	-	mm
	Length	L_L		**165**		
	Depth	L_D		**105**		
Secondary cable length (FAA-style connector)		L_{SC}	-	**250**	-	mm
Weight			-	**4.3**	-	kg

[3] For max 1s, in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors).

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LMS 591886

User´s Guide

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CONTENTS

1 Revision History **3**
2 Application **3**
3 Abbreviations **3**
4 References **3**
5 Introduction **3**
6 Compatibility **4**
7 Operational characteristics **4**
7.1 Power On or Default State 4
7.2 Safe State 4
7.3 Command Memory 4
7.4 Soft ON/OFF 5
7.5 Active failed lamp state response 5
7.6 RGL functionality 5
7.7 "Running rabbit" 5
8 Operational indications **5**
9 Programming **6**
10 Electrical and Mechanical Characteristics **6**
11 Installation **8**
11.1 Replacement of lamp 9
11.2 Calculating Transformer Rating 9
12 Troubleshooting **10**
13 Orderable parts **10**

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comment*
JF	040819	0.0	
JF	050214	1.0	Updated with 591886-11

2 APPLICATION

This document explains and describes the LMS 591886 from both a technical- and an operational perspective.

3 ABBREVIATIONS

ASP	Airfield Smart Power
LMS	Light Monitor and Switch Unit
SIU	Sensor Interface Unit
SFU	Signal Filter Unit
SCM	Series Circuit Modem
MBD	Microwave Barrier Detector
AMT	ASP Maintenance Tool
LPU	LMS Programming Unit

4 REFERENCES

SG591891-3006	AMT User’s Guide

5 INTRODUCTION

The LMS 591886 is one of several components in an ASP System, which normally is installed in manholes/hand holes the field. Other such components are the SIU and the SFU.

The basic function of a LMS 591886 is to control and monitor on lamp (single-LMS) or two lamps separately (dual-LMS).

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The LMS communicates over the series circuit with the SCM using a unique power line communication technique developed by Safegate. From a system perspective the SCM controls the communication (master) and the LMS and the SIU respond to its commands (slave).

The LMS will on command either turn on or turn off or flash the lights connected to it. In addition the LMS back indicates the status of the lamps to the SCM. Lamp status includes both lamp filament status and operational status, i.e. if the lamp is on, off, flashing or defect.

6 COMPATIBILITY

The dual LMS 591886 is the first generation LMS with dual lamp output, therefore, there is no need for backwards compatibility from a hardware perspective. From a system perspective, a dual LMS 591886 can be used in older ASP-system at a system extension, if needed.

The single LMS 591886 is compatible with both LMS 591835, 591817 and 591803. This implies that a single LMS 591886 can be used as spare (transparently) in a system originally equipped with LMS 591803, 591817 or 591835.

7 OPERATIONAL CHARACTERISTICS

To which extent all LMS functionalities are used, is determined by the application. This means that all functionality described in this document is not necessary used at a specific installation. Below is a summary of the most prominent functionalities that are available in LMS 591886.

7.1 Power On or Default State

The LMS is configured to set the lamp to a predefined state when the series circuit is energized. This feature is called *default state* and the options are LAMP ON, LAMP OFF or LAMP FLASHING. Which option to select depends on the light function to which the LMS belongs and the operative requirements.

7.2 Safe State

In case the communication between the LMS and the SCM is interrupted or lost the LMS will after a programmable timeout set the lamp to a predefined state known as *safe state*. Safe state can be set to LAMP ON, LAMP OFF, LAMP FLASHING or *no change*.

7.3 Command Memory

When the current in the series circuit is lost because the CCR is turned off or for any other reason, the LMS will remember the current lamp status for a limited

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amount of time. The LMS can be configured to, once current is restored in the circuit, set the lamp to the remembered state, typically the last commanded state before power was lost. This feature will, when enabled, override the *default state*.

It's possible to apply a condition based on the amount time current was gone and have the LMS set the lamp to *default state* if current was restored beyond this time limit. The time limit is programmable from one to approximately 20 seconds.

7.4 Soft ON/OFF

The LMS can be programmed to delay the physical turn on or turn off of the lamp upon reception of a command from the SCM. The feature is called *SoftON/SoftOFF* and its purpose is to mitigate the sudden load change to which the CCR is subjected when a large portion of the load is commanded on or off with a single command. The command acknowledge from the LMS will not be affected, and thereby neither the responsetime. Without this feature it might not be possible to turn on or off all or most lights on a circuit with a single command without the CCR tripping either because of over- or under-current.

The physical delay is programmable on an individual level in 10ms increments. There will be no response time impact when SoftON/SoftOFF is enabled.

7.5 Active failed lamp state response

The LMS 591886 can be programmed to actively report failed lamps, which makes it possible, on system level, to keep distinct a failed lamp from a failed LMS.

7.6 RGL functionality

The LMS can be used as a RGL flasher, maintain flashing synchronisation in compliance with official standards.

7.7 "Running rabbit"

The LMS can be used to create different types of "running rabbit" patterns on the series circuit.

8 OPERATIONAL INDICATIONS

As the LMS is an airfield device, there are no visible operational indications on the unit, other than that at the field level by the ability to turn ON/OFF/FLASH the lighting as commanded.

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9 PROGRAMMING

The (application specific) functional properties of a LMS are controlled by a set of parameters originally downloaded to the unit prior to installation. These parameters may also be modified after installation. The mechanism used to download parameters to a LMS in the field uses the same power line communication channel used for commands from the SCM and status back indication from the LMS.

Normally all necessary information for programming a LMS being a part of an ASP System is contained in a database, unique to each system. If an LMS needs to be replaced, parameters are fetched from the database and downloaded to the unit, using a *LMS Programming Unit* (LPU).

For programming procedures, refer to document *SG591891-3006 AMT User's Guide*.

10 ELECTRICAL AND MECHANICAL CHARACTERISTICS

Unless differently noted, all maximum values are absolute maximum values.

Characteristic	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Series Circuit					
Supply current from series circuit (50/60Hz)	I_{SUPPLY}	2.5	-	7.1[1] 8.2[2]	A_{RMS}
Peak input voltage series circuit terminals Single LMS	V_{SUPPLY}	-	-	130	VAC
Peak input voltage series circuit terminals Dual LMS	V_{SUPPLY}	-	-	260	VAC
Isolation voltage	V_{ISO}	1500	-	-	VAC
Interface isolation transformer rating	P_{IT}	45	-	500	W
Output					
Lamp wattage each lamp @ 6.6 A_{RMS}	P_{LAMP}	0	-	300[3]	W
Miscellaneous					
LMS power consumption @ 6.6 A_{RMS} Single LMS	P_{LMS}	-	7.5	10	W
LMS power consumption @ 6.6 A_{RMS} Dual LMS	P_{LMS}	-	7.5	11	W
Environment					
Operating humidity range	RH	0	-	100	%
Operating temperature range	T_A	-30	-	+65	°C
Storage temperature range	T_{STG}	-30	-	+100	°C
Encapsulation class	IP68				

[1] In accordance with FAA advisory circular 150/5345-47A (Isolation transformers for airport lighting systems).
[2] For max 1s, in accordance with FAA advisory circular 150/5345-10E (Specification for CCRs and regulator monitors).
[3] Provided $I_{PEAK}/I_{RMS} \leq 2.9$.

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Characteristic		Symbol	Min	Typ	Max	Unit
Dimensions excluding cables Single LMS	Width	L_W	-	**133.5**	-	Mm
	Length	L_L		**106.5**		
	Depth	L_D		**51.5**		
Dimensions excluding cables Dual LMS	Width	L_W	-	**133.5**	-	Mm
	Length	L_L		**133.5**		
	Depth	L_D		**51.5**		
Secondary cable length		L_{female}	-	**0.4**	-	M
		L_{male}		**0.2**		M
Weight Single LMS			-	**1.4**	-	Kg
Weight Dual LMS			-	**1.6**	-	Kg

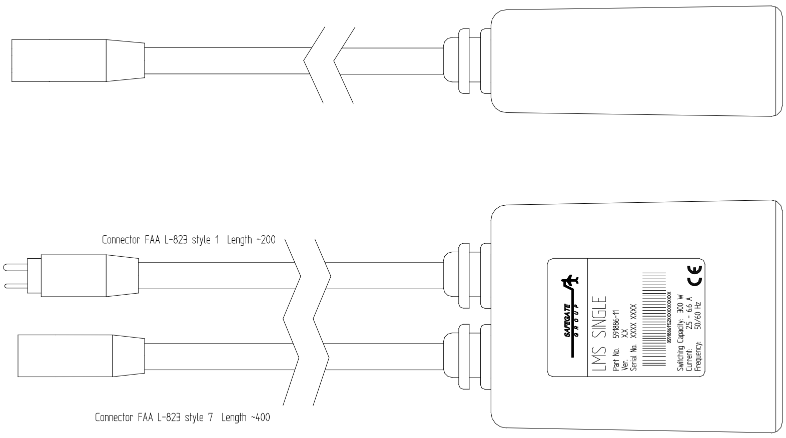

Fig 10.1 Outline drawing single LMS 591886-11

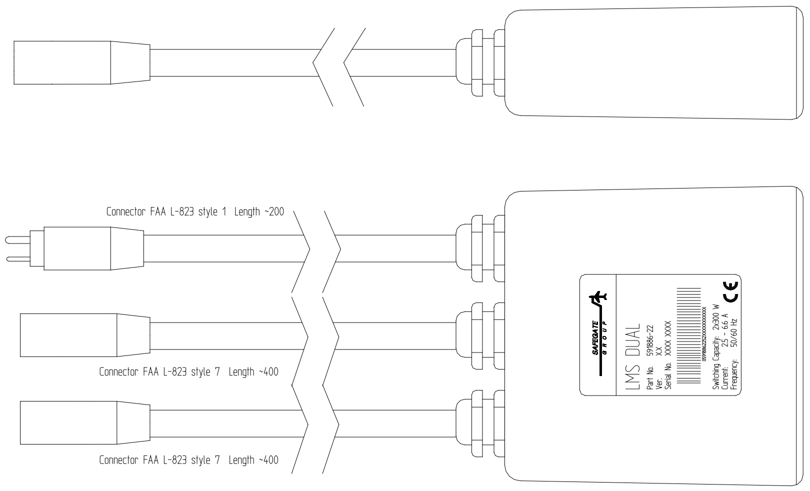

Fig 10.2 Outline drawing dual LMS 591886-22

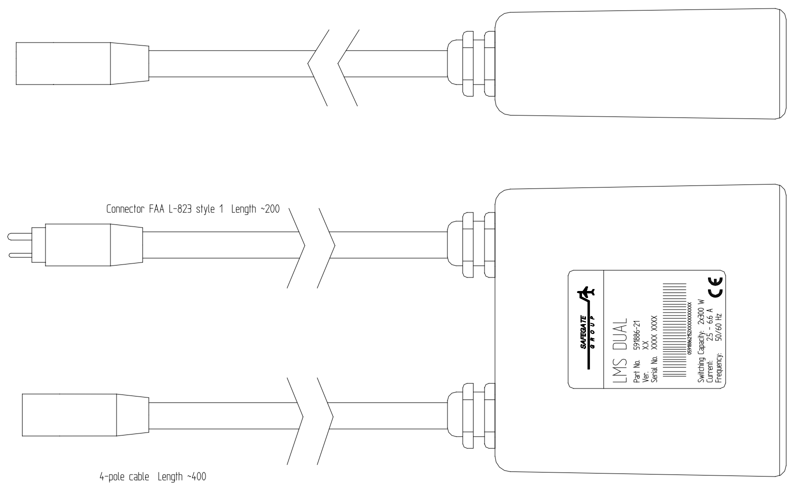

Fig 10.3 Outline drawing dual LMS 591886-21

11 INSTALLATION

The dual LMS 591886 connects to the secondary of a standard isolation transformer and to one or two lamps (see 9.3.1 for details on recommended transformer rating).

Note that the LMS supports grounded as well as ungrounded configurations but no more than one ground point on the isolation transformer secondary is allowed.

In other words, either the secondary of the isolation transformer or the lamp fixture may be grounded but not both. If both sides are grounded the LMS will not work properly.

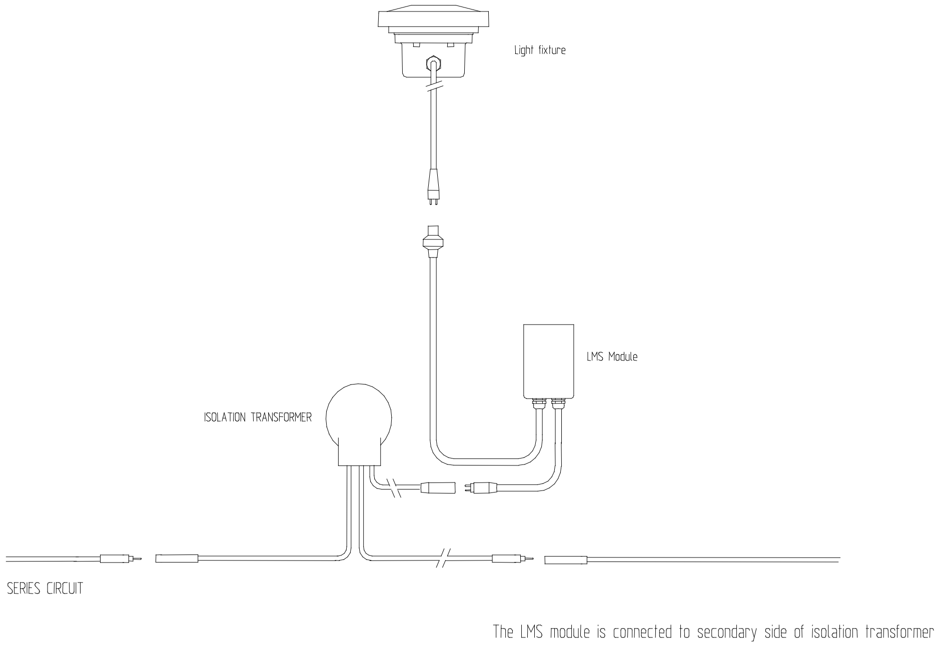

Fig 11.1 Installation of LMS

11.1 Replacement of lamp

For the LMS to detect a replaced lamp after a lamp failure, both lamps must be disconnected and after that reconnected with two good lamps (applies only to dual lamp LMS). This procedure does not impose any restrictions on the normal maintenance procedures, as replacement of a lamp normally is carried out by replacing the whole fixture.

11.2 Calculating Transformer Rating

To calculate the (recommended) minimum power rating for the isolation transformer to which the LMS is connected, use the following formula:

$P_{IT} = P_{LAMP1} + P_{LAMP2} + P_{LMS} + (0.0344 \times 6.6^2 \times (L_{LAMP1} + L_{LAMP2}) / A)$, where A is the cross section for the cable between the LMS and the lamp [mm^2], L_{LAMP1} and L_{LAMP2} are the length of the cables, P_{LAMP1} and P_{LAMP2} are the lamp wattages and P_{LMS} is the LMS power consumption worst case = 10 W.

For 2,5 mm^2 cable the above translates to

$P_{IT} = P_{LAMP1} + P_{LAMP2} + 0.6(L_{LAMP1} + L_{LAMP2}) + 10$

and for 4,0 mm^2 to

$P_{IT} = P_{LAMP1} + P_{LAMP2} + 0.4(L_{LAMP1} + L_{LAMP2}) + 10$

The formula does not take into account tolerances of the isolation transformer power rating nor does it account for the efficiency and the ratio of the transformer. Consequently, the calculated transformer rating is conservative but nevertheless it’s not recommended to use transformers with power rating below the calculated.

12 TROUBLESHOOTING

Among the most common causes for failure or malfunction is erroneous installation in terms of bad cables, ground faults, shorts through e.g. water penetration in the light fixture, problems with the installation transformer and/or defective connectors.

If the problem remains even after the above have been confirmed okay, replace the LMS. If the problem remains after replacement this indicates that the cause is most likely to be found in the installation.

13 ORDERABLE PARTS

The LMS comes in three versions, the difference is how the LMS is interfaced to the lamps:

591886-11	Single LMS with one FAA-style7 connectors.
591886-21	Dual LMS with two FAA-style7 connectors.
591886-22	Dual LMS with “Swedish-style” 4-pole connector (Amerace part no 95-04MR)

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Microwave Barrier Detector MBD - 596530

User's Guide

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CONTENTS

1 Revision History **3**
2 Scope **3**
3 Application **3**
4 Abbreviations **3**
5 References **3**
6 General **4**
7 Characteristics **4**
7.1 Specifications 4
7.1.1 Physical appearance 4
7.1.2 Specification 5
7.1.3 Miscellaneous 5
8 Installation **6**
8.1 Placing the MBD 6
8.1.1 System functionality 6
8.1.2 MBD functionality 6
8.1.3 Safety 7
8.1.3.1 Reference 7
8.1.3.2 Runway/taxiway dimensions 7
8.1.3.3 Aircraft dimensions 7
8.2 Risk Analysis 8
8.2.1 Risk of collision 8
8.2.1.1 Hazardous events 8
8.2.1.2 Risk minimizing measures 8
8.2.1.3 Risk estimation 8
8.2.2 Risk of FOD 9
8.2.2.1 Hazardous event 9
8.2.2.2 Risk minimizing measures 9
8.2.2.3 Risk estimation 9
8.2.3 EXAMPLE 9
8.3 Installation hardware 10
8.3.1 Preparations 10
8.3.1.1 Precautions 10
8.3.2 Mounting the MBD 11
8.3.3 Wiring work 11
8.3.4 Securing the MBD and post 11
8.4 Connecting Transmitter and Receiver 12
8.5 Commissioning the MBD 13
8.5.1 Indicators and jumpers 13
8.5.1.1 Transmitter 13
8.5.1.2 Receiver 13
8.5.2 Channel selection 14
8.5.3 Alignment and testing 14
8.6 Documenting the installation 16
9 Maintenance **16**
10 Troubleshooting **17**
11 Appendix – MBD microwave beam pattern **18**
12 Appendix – MBD Installation Data **19**

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1 REVISION HISTORY

Ver	Date	Remark	Author
0.1	020214	Document created, draft.	JF
1.0	020215	Released	JF
1.2	030429	Revised	ÅP
1.3	050323	Installation directives and Risk analysis added	ÅP
1.4	060517	Appendix – MBD microwave beam pattern added	JF

2 SCOPE

This document describes the *MBD - Microwave Barrier Detector* in its application in the ASP®-System provided by Safegate.
Refer to the original documentation *Technical Manual for Model 310B Outdoor Microwave Link* (included in the delivery) for a more detailed description.

3 APPLICATION

This document explains and describes the MBD from an operational perspective in the ASP®-System and covers specifications, installation, maintenance and troubleshooting of the MBD. Applies to product versions 596530-1, -2 and -3.

4 ABBREVIATIONS

ASP	Airfield Smart Power
MBD	Microwave Barrier Detector
SIU	Sensor Interface Unit
SCM	Series Circuit Modem
CU	Concentrator Unit

5 REFERENCES

SG591885-3018	SIU User's Guide	
SG596530-3015	MBD Installation data	(see Appendix)
SG596530-3009	Manual Testsystem RM82	

Technical Manual for Model 310B Outdoor Microwave Link

6 GENERAL

The MBD setup is integrated to the ASP®-System for use in detection of aircraft and vehicles at strategically located positions in the airfield. The MBD setup uses a separate Transmitter and Receiver unit, a detector pair, as a means of creating a "line-of-detection" type signal path.

When an aircraft or vehicle crosses this signal path, detection is registered by a "loss or influence of microwave signal" on the receiver end of the detector pair and the MBD reports detect to the SIU.

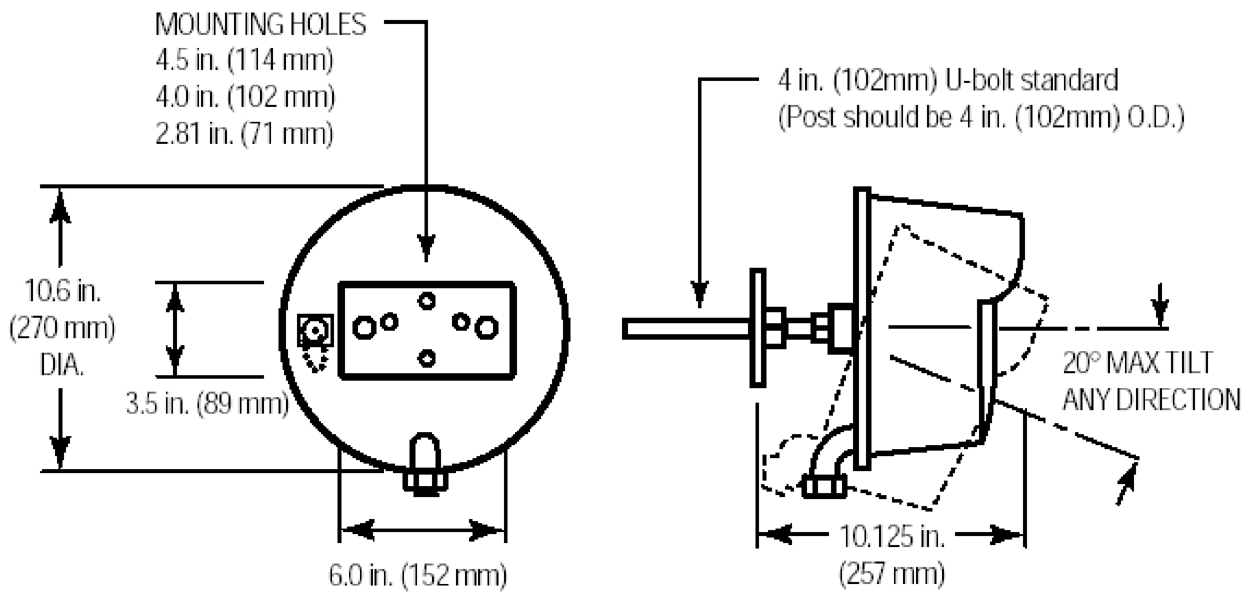
An MBD pair connected to SIU supports autonomous "sensor test". More details on this subject can be found in the User's Guide for the SIU, *SG591885-3018*.

7 CHARACTERISTICS

7.1 Specifications

7.1.1 Physical appearance

The MBD 596530 consists of two units, Transmitter and Receiver, each with a mounting bracket for a ∅100mm (or ∅60mm) post.



7.1.2 Specification

Specification	Symbol	Min	Typ	Max	Unit
Operational					
591830-1, 591830-3 Distance between transmitter and receiver	L_{range}	20	-	**120**	m
591830-2 Distance between transmitter and receiver	L_{range}	30	-	**450**	m
Target velocity (@ 36 kg, ∅ 30 cm) *Rem. For large objects (aircrafts, vehicles) the maximum target velocity will be noticeably higher*	v_t	0,03 0,1	- -	15 54	m/s km/h
Power requirement					
Voltage supply transmitter or receiver	V_s	11	**12**	14	VDC
Current consumption transmitter	I_{tx}	90	**120**	150	mA
Current consumption receiver	I_{rx}	15	**20**	25	mA
Microwave					
596530-1, 596530-3 Signal peak power	$P_{s\ (peak)}$	-	**0,5**	-	mW
596530-1, 596530-3 Signal average power	$P_{s\ (avg)}$	-	**0,25**	-	mW
596530-2 Signal peak power	$P_{s\ (peak)}$	-	**6**	-	mW
596530-2 Signal average power	$P_{s\ (avg)}$	-	**3**	-	mW
Carrier frequency (K-band)	$f_{carrier}$	-	**24,200**[1]	-	GHz
Mechanical					
Dimensions, transmitter and receiver	∅ Depth	- -	**270** **224**	- -	mm mm
Weight, transmitter and receiver		-	**2**	-	kg/each
Environmental					
Operating temperature		-40	-	+66	°C
Humidity		0	-	100	%

NOTE: Maximum distance for reliable function varies depending on installation height, flatness and structure of the pavement and terrain.

7.1.3 Miscellaneous

Electrical fuses:

- Transmitter: 0,5 A (fast), 6,3x32 mm
- Receiver: 0,25 A (fast), 6,3x32 mm

Contact data for Alarm relay and Tamper switch: 28VDC / 2A

The MBD units have **CE** approval.

[1] Other frequencies in the K-band (country specific) available on request

8 INSTALLATION

8.1 Placing the MBD

Before placing the MBD, an analysis must be made to ensure:

- System functionality
- Sensor functionality
- Safety

8.1.1 System functionality

The MBD pair must be installed so that its “line of detection” is at the intended position to monitor *(e.g. just behind a stopbar on the taxiway).*

8.1.2 MBD functionality

- Please observe that the maximum allowable distance between the sensor Transmitter and Receiver must be respected. The maximum range will be limited by the terrain and how well vegetation and snow are removed. Although the “maximum” distance is said in the datasheet to be 450 m (*low power model:120 m*) it is recommended to keep the distance within 120 m (*low power model: 80 m*), especially in areas where heavy rain or snow can be expected.
- The area between Transmitter and Receiver must be free of tall grass, weeds, debris and obstructions.
- The Transmitter and Receiver must be mounted on a rigid surface or post as unwanted vibrations may cause spurious detections. Read more in section 8.3.
- For proper function of the MBD, the "line of aim" between the Transmitter and the Receiver must be “high enough” above the crest of the runway/taxiway, typically between 60 cm and 115 cm - this is to avoid problems due to microwave multipath interference. A suitable height will be decided at commissioning - until then, the posts should be long enough to allow for adjustment up to 115 cm “above the crest”. Read more in section 8.3.
- The Transmitter and Receiver must be powered at all times monitoring of vehicles is desired. When using the SIU to power and monitor the Transmitter and Receiver, the isolating transformer supplying the SIU must be connected to a series circuit that is powered. Read more in section 8.4.
  Loss of power will disable the MBD sensor function and hence no vehicle movements can be monitored.

8.1.3 Safety

All means must be taken to ensure that the MBD installation does not reduce the safety or increase the risk of a potential collision. The following reasoning refers to applicable standard, runway/taxiway width and camber, current aircrafts and their dimensions. In the following text the MBD will be referred to as the Sensor.

8.1.3.1 Reference

Applicable standard (ICAO Annex 14, Fourth Edition July 2004),

9.9 Siting of equipment and installations on operational areas says:

9.9.4 **Recommendation**. - *Any equipment or installation required for air navigation purposes which must be located on the non-graded portion of a runway strip should be regarded as an obstacle and should be frangible and mounted as low as possible.*

8.1.3.2 Runway/taxiway dimensions

The width of a runway depends on its code and is typically 30, 45 or 60 m.

To promote drainage of water the surface should be cambered - the transverse slope should not exceed 1.5% (code C, D, E or F) or 2% (code A or B). In case the landing gear is near or at the edge of the runway there will be an inclination of wings caused by this cambering, i.e. the ground clearance will be reduced outside the edge.

8.1.3.3 Aircraft dimensions

To avoid *collision Aircraft – Sensor*, the placing of the MBD is restricted by the dimensions of aircrafts operated at the airport - of most interest are:

- Distance between outer point of landing gear and outer point of outer engine
- Distance between outer point of landing gear and outer point of wing
- Ground clearance outside the outer engine

These data can be found in manuals ("Airplane Characteristics for Airport Planning") from the aircraft industry, e.g. for:

- Boeing
  http://www.boeing.com/assocproducts/aircompat/plan_manuals.html
- Airbus
  The consultation and download of technical data are available for registered users in the Airbus customer portal Airbus|World at www.airbusworld.com

8.2 Risk Analysis

8.2.1 Risk of collision

8.2.1.1 Hazardous events

Foreseeable hazardous events:

- *Collision Landing gear - Sensor*
- *Collision Engine - Sensor*
- *Collision Wing - Sensor*

8.2.1.2 Risk minimizing measures

- Sensors shall be placed as far as possible from the runway/taxiway edge to minimize the risk of collision.
- Highest point of Sensor shall be significantly lower than the lowest point of any part of the aircraft that may pass above the sensor while the landing gear is on and not beside the runway/taxiway.
- The sensor construction is made frangible (the post has an integrated breakable coupling) and its mass is low.

8.2.1.3 Risk estimation

I. For a *collision Landing Gear - Sensor* to occur, an aircraft must pass with its landing gear outside the runway/taxiway edge. The risk of such a collision is considered to be negligible compared to other risks in that situation.

II. For a *collision Engine - Sensor* to occur, while the landing gear is on and not beside the runway/taxiway, the distance between runway/taxiway edge and Sensor must be less than the distance between Landing Gear and Engine. Provided that the sensors are installed such that the distance between runway/taxiway edge and sensor is greater (with a *safety margin of 2 m*) than the distance between Landing Gear and Engine, the probability for a collision Engine - Sensor is negligible.

III. For a *collision Wing - Sensor* to occur, while the landing gear is on and not beside the runway/taxiway, the lowest point of the wing passing above the Sensor must be lower than or equal to the highest point of the sensor. Provided that the sensors are installed such that there is a *safety margin of at least 1.5 m* between said points of the wing and sensor, swing and inclination (due to cambering of runway/taxiway) of wings will be allowed for and the probability for a collision Wing – Sensor will be negligible.

8.2.2 Risk of FOD

(foreign object debris / foreign object damage)

8.2.2.1 Hazardous event

Foreseeable hazardous event:

- Damage on aircraft or human caused by sensor head, mounting assembly or post being teared off, e.g. by the "jet blast".

8.2.2.2 Risk minimizing measures

The sensor head, mounting assembly and post are secured to the concrete base with a safety catch wire as instructed in this manual (MBD User's Guide).

8.2.2.3 Risk estimation

The probability for loose objects causing any damage on aircraft or human is reduced to a minimum by using the safety catch wire.

The risk of FOD is therefore considered to be negligible.

8.2.3 EXAMPLE

Currently, the longest distance between landing gear and engine is found on the B747: approx. 16 m. (for the new A380 this distance is approx. 20 m, however only a few airports will be trafficked by this aircraft).

Provided that the Sensor is placed at least 18 m away from the edge and looking only at aircrafts where the wing span is wide enough to pass above the sensors, the lowest point of the wing above ground will exceed 3 m (least found marginal is for B707-320/420).

Provided that the Sensor <u>protrudes above the ground level</u> at runway/taxiway edge <u>less than 1.5 m</u>, the clearance will be at least 1.5 m allowing for swing and inclination (due to cambering of runway/taxiway) of wings.

For a runway width of 60 m the <u>distance between a Sensor pair</u> (Transmitter and Receiver) will then need to be 60+18x2=<u>96 m or more</u> (<120 m).

8.3 Installation hardware

8.3.1 Preparations

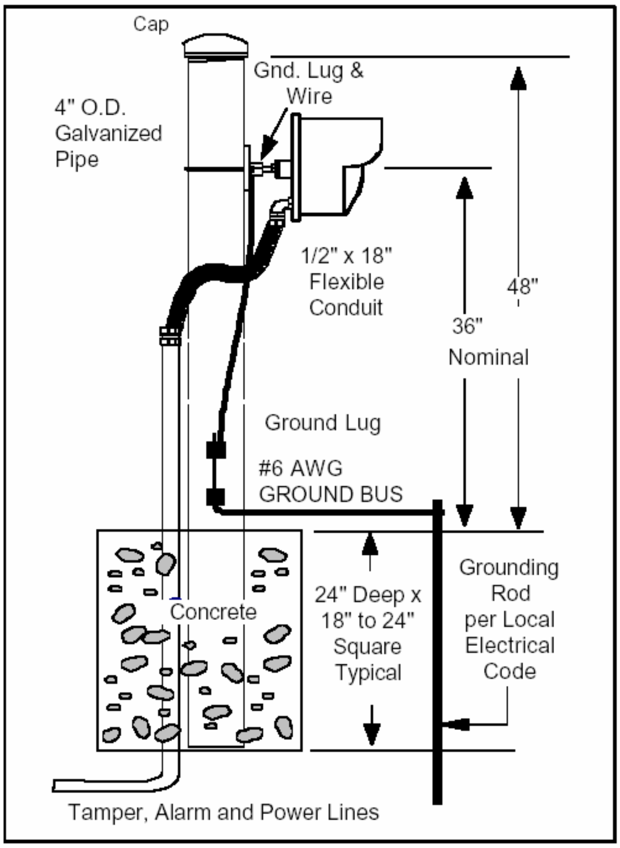
Prepare a rigid mounting surface for the MBD Transmitter and Receiver. Do not mount units on a vibrating surface or post.

A recommended mounting post is a 3 ½ inch (90 mm) galvanized pipe (outside diameter 4 inches, 100 mm), attached to a (prefabricated) concrete base. A 60mm post may be used if that better suits the prefabricated base. The post should protrude above ground level “of the area to guard” (center/crest of Taxiway/Runway) to a height of 4 feet (1.2m) – this implies the posts must be higher when mounted on shoulders that fall off from the Taxiway/Runway edges.

See figure below for an example.

8.3.1.1 Precautions

<u>The posts should have an integrated breakable coupling</u> to allow for collapse if submitted to a hitting object, such as an aircraft or vehicle. <u>The breakable coupling must be located just above ground level!</u>



8.3.2 Mounting the MBD

1. Remove the MBD units from the shipping containers. Separate the swivel assembly from the mounting plate by turning the large nuts counter-clockwise. Large nuts require 1 ¼ inch (32mm) open-end wrench.
2. Secure the mounting bracket to the post with U-bolt or to other mounting surface with appropriate screws or fasteners.
3. Secure the swivel assembly to the Transmitter and Receiver and attach to mounting bracket.
4. Rotate the Transmitter and Receiver so that the conduit fittings are pointed straight down.
5. Tighten the large nuts on the swivel assembly to hold the units in place.
6. Mount the Transmitter and Receiver 2 ½ to 3 feet (0.75 to 1.0m) above ground level "of the area to guard" (center/crest of Taxiway/Runway) and allow for height adjustment of at least plus or minus 6 inches (15cm). Height adjustment may be required during final alignment to achieve optimum protection pattern.

8.3.3 Wiring work

An 18-inch (46cm) ½ inch flex conduit is recommended between conduit fitting of MBD units and rigid conduit. Continue from here with a conduit to the manhole (pit) where the related SIU is located.

Insert wires through conduit fitting. Leave enough slack in wires so that the MBD units may be adjusted in height and tilted after radomes are replaced.

NOTE: After wiring is complete, it is recommended that entry conduit be filled sealed) with non corrosive sealant such as Dow-Corning #738 RTV. This will prevent moist air in the conduit system from entering the MBD Transmitter or Receiver.

8.3.4 Securing the MBD and post

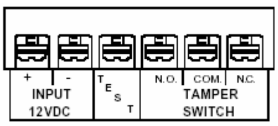
Securely fasten a ring bolt to the concrete base. A ring bolt should also be mounted on the lower part of the post, just above the breakable coupling.

A safety catch wire with spring safety hooks attached at both ends should then be fastened between the base ring bolt and the MBD. The wire should pass through the post's ring bolt and then be connected to e.g. the swivel assembly between the mounting plate and the MBD head.

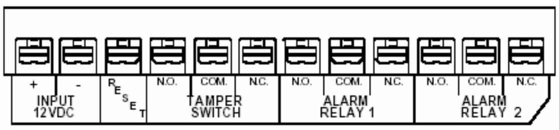
8.4 Connecting Transmitter and Receiver

The procedure is the same for both Transmitter and Receiver unit.

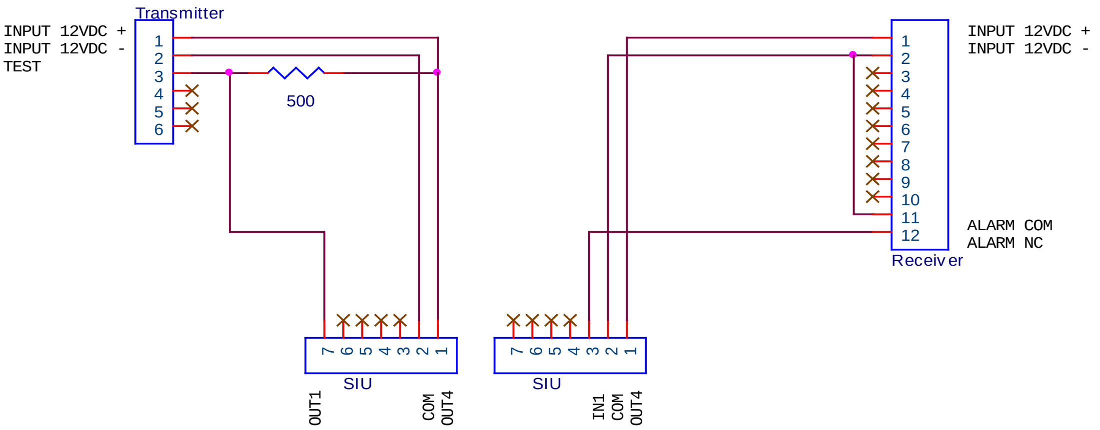
- Remove the radome of the MBD by removing the six radome screws.
- Insert power and alarm circuit (RX only) wires through conduit fitting. Leave enough slack in wires so that the unit may be adjusted in height and tilted after radome is replaced.
- Make connections to the terminal strip according to labelled terminal functions (See Figure)
- Observe the resistor (500 Ohm) in the Transmitter and the jumper in the Receiver.
- Attach power wires to terminal identified as +12VDC (Positive) and GND (Negative). OBSERVE POLARITY.
  (wrong polarity will blow the fuse - Keep spare fuses available)
- If not continuing with the commissioning at this stage, replace radomes on Transmitter and Receiver using all six screws.



310BT TRANSMITTER



310BR RECEIVER

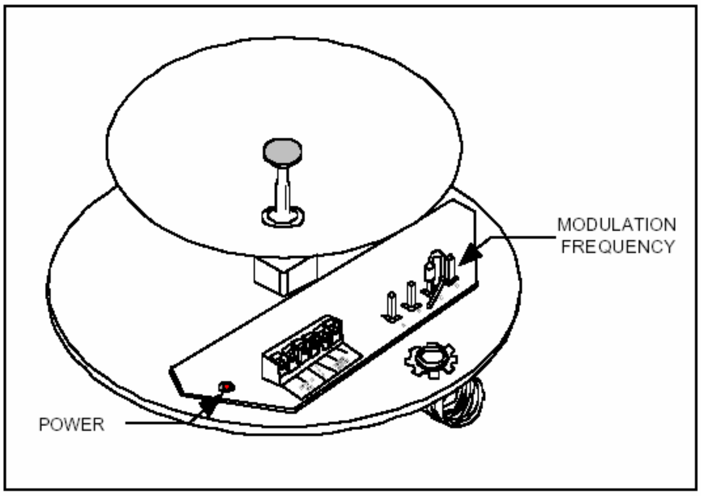


8.5 Commissioning the MBD

8.5.1 Indicators and jumpers

8.5.1.1 Transmitter

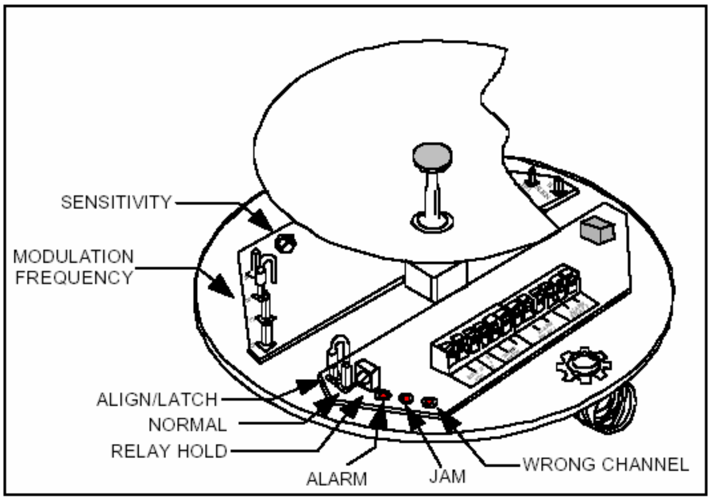
MODULATION FREQUENCY:	Channel selection field: A – B – C – D
POWER (LED):	Power indication



8.5.1.2 Receiver

MODULATION FREQUENCY:	Channel selection field: A – B – C – D
ALARM (LED):	Indicates detection of an object
JAMMING (LED):	Indicates interference with other Tx unit [2]
WRONG CHANNEL (LED):	Indicates Tx & RX set to different channels

[3],



[2] Could also give ALARM
[3] Could also give ALARM

ALIGN/LATCH alt. NORMAL: ALIGN/LATCH latches ALARM on detect, faster tracking of align level when using RM82 (Link Performance Test Set).

FAST/SLOW (not visible in figure): Selection of maximum speed for the object to be detected: **15 m/s** or 3 m/s (these figures are not direct applicable, but indicate fast or slow response to an object)

RELAY HOLD (HOLD IN): Adjustable hold time (0,5-60 sec) at ALARM

SENSITIVITY: Adjustable sensitivity - applies to the size, weight, geometry and speed of the object

8.5.2 Channel selection

The MBD features four (4) field selectable modulation frequencies. It is advantageous to use different modulation frequencies on MBDs operating within close proximity. Different modulation frequencies reduce the possibility of cross-link modulation or mutual interference. Attach PCB jumper wire to appropriate terminal to select desired channel (A, B, C, D). The Receiver and Transmitter MUST be operated on the same frequency or an alarm condition will result.

8.5.3 Alignment and testing

To set up the MBD Transmitter and Receiver:

1. Apply power to the Transmitter and Receiver. If MBD is powered by an SIU the corresponding series circuit (CCR) must be energised.
2. Remove the radomes from both Transmitter and Receiver. Make sure the identical modulation frequency is being used on the Transmitter and Receiver.
3. Visually aim the Transmitter and Receiver for "bore-sight" alignment.
4. On the Receiver: Move the "ALIGN/LATCH – NORMAL" jumper to **ALIGN/LATCH** position.
5. Connect the RM82 to the MS connector on the back of Receiver - select ALIGN on RM82, alternatively connect a Voltmeter to TP1 and GND on the Receiver PCB.
   This level to be observed will from now on be referred to as **ALIGN-level**.
6. Swivel Receiver up and down, side to side, raise or lower to obtain maximum **ALIGN-level**. Tighten locking nut on mounting bracket to secure sensor in this position.
7. Swivel Transmitter up and down, side to side, raise or lower – at the same time, at the Receiver, observe meter to obtain maximum **ALIGN-level**. Tighten locking nut on mounting bracket to secure sensor in this position.

- **The ALIGN-level must exceed 0.1 (RM82)** alt. 0,5 V (Voltmeter) **– normally you should expect at least the double value (>0.2** / >1,0 V**)**

8. Disconnect the RM82 or Voltmeter and move the "ALIGN/LATCH – NORMAL" jumper back to **NORMAL** position.
9. Move the "FAST/SLOW" jumper to **FAST** position, set HOLD IN to minimum (max. CCW) and adjust to lowest sensitivity, i.e. SENSITIVITY max. CCW.

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10. Make a "Walk-Test", while monitoring the ALARM indication LED, to check that the MBD is working.

11. Use a fast vehicle (car) to check that the MBD detects at desired (high) speed when passing at the mid, left and right side of the taxiway. Normally **SENSITIVITY** must be raised, typically to **2/7** of scale (2nd scale division). To avoid spurious detections, do not turn SENSITIVITY beyond mid setting.
12. Replace radomes on Transmitter and Receiver using all six screws. Make sure the protecting cap for the MS connector on the Receiver is replaced.

8.6 Documenting the installation

To make maintenance and follow-up easier should, for all MBDs in the installation, the following should be recorded in the **MBD Installation data** document:

- Distance Transmitter - Receiver
- Mounting height, Transmitter and Receiver
- Supply voltage, Transmitter and Receiver
- Channel selection (A – B – C – D)
- Jumper settings (ALIGN/LATCH – **NORMAL** , **FAST**/SLOW)
- SENSITIVITY setting
- HOLD IN setting
- ALIGN-level (RM82)

When maintaining, troubleshooting or replacing defect units recorded values and data should be checked and updated.

Make some notes, when applicable:

- *Waxing of radomes - date !*
- *Maintenance – specify, date !*

9 MAINTENANCE

After setting up the MBDs at installation, as described above, no further calibration should be required. To remain a trouble free system we recommend to:

1. **Wax the radomes** every 3 to 6 months. Use "Turtle clear vinyl top wax" or equivalent. This will make the water and dust easier run off and will reduce the risk for signal drop (which can cause spurious detections).
2. **Keep the area between Transmitter and Receiver clean and free** of tall grass, weeds, debris, and obstructions. Wintertime, keep the area **free from snow** – snow obstructions may affect the microwave pattern and thereby block a real or cause a spurious detection.
3. Inspect the MBD installation periodically (at least every 6 months). At the time for inspection, check and update the installation data (see above), look for any damages (cracks, leakage, rust, etc.), check and clear the area if required not to interfere with the function of the MBD.
4. **Repair** if required and take measures against **potential problems**.
5. **Record** all maintenance performed in the **MBD Installation data** document.

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10 TROUBLESHOOTING

In this system, for detection of vehicle movements on taxiways and runways, the MBD constitutes the lowest level. The system includes:

- MBD - Transmitter and Receiver that together form a "line of detection"
- SIU - same for Transmitter and Receiver (power supply, status reading, self test of MBD's "line of detection")
- SCM - collects, via SIU, status for MBD
- CU - transfers MBD-status from SCM to host system
- Host system - presentation of Sensor-status (detection, fault)

MBD and SIU (together) are treated as a **Sensor** by the host system and at a fault condition, either on the MBD or SIU, a common fault indication is given for the Sensor in the host system.

A Sensor fault could appear either at the MBD, the cable between MBD and SIU, or at the SIU – *we will focus on the MBD and the cable between MBD and SIU.*

START by checking that:

- Transmitter and Receiver are aligned correctly and free from damages
- Transmitter and Receiver are both supplied with power
- All jumpers and settings are according to what has been registered in the **MBD Installation data** document**.**

FAULT OBSERVATION / Reason:

- Not detecting at all or just sometimes
  - SENSITIVITY setting is to low
  - Cable fault - Pin 3 (DET) is in contact with "low"
  - MBD-Receiver bad
- Detecting continuously or "without reason" (no blocking object)
  - Transmitter and Receiver not aligned correctly
    - ➢ Check ALIGN-level with RM82
  - Cable fault - Transmitter or Receiver not connected (contact loose)
  - Cable fault - Pin 3 (DET) in contact with "high"
  - Cable fault - Pin 7 (TEST) in contact with "high" or not connected
  - SENSITIVITY setting is to high
  - Fuse blown in Transmitter or Receiver
  - MBD-Receiver bad
  - MBD-Transmitter bad

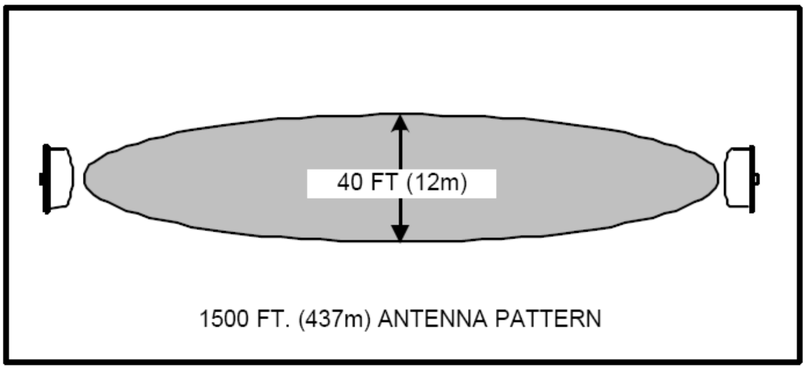
Observe that all four (4) connectors (only 2 are being used) on the SIU are in parallel. Thereby a suspected cable fault could exist in any of the cables or connectors for the Transmitter or the Receiver

- Adjust or repair when required. Make note in the **Installation data** document

11 APPENDIX – MBD MICROWAVE BEAM PATTERN

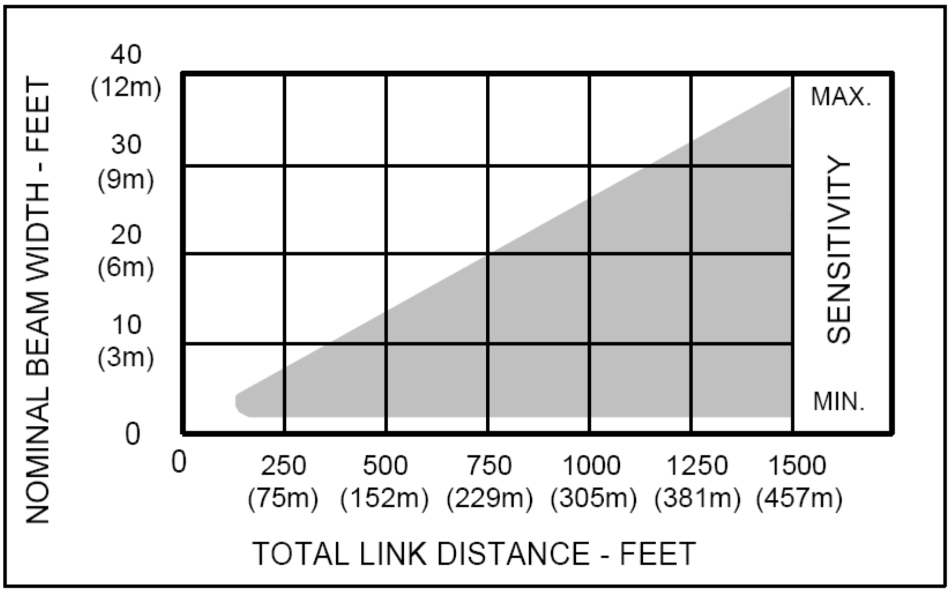
This section is intended to be a technical orientation of the MBD beam pattern. Note that below figures are typically valid at the mounting height of the MBD.

Typical maximum width protection pattern of the MBD is shown in the figure below, for mounting height of 0.75m above smooth earth.



Maximum width occurs when Transmitter-Receiver distance is maximum and Receiver "Sensitivity" control is set to maximum.

The figure below illustrates how pattern width varies with Transmitter-Receiver distance and sensitivity setting. Actual patterns will vary somewhat with site topography and surface condition. Generally, lower mounting height or rougher surface will increase pattern width. For example, if the total link distance is 230m and the sensitivity adjustment set to mid-point, the figure indicates the detection pattern width to be 3.6m.



12 APPENDIX – MBD INSTALLATION DATA

MBD
Installation data

Site:	
Position:	

Document Number		Rev.
SG596530-3015		**-**
Drawn/Design	Checked	Approved
ÅP	**OH**	**OH**

Safegate International AB
Sweden

GENERAL								
Date								
Signature								
Distance Transmitter - Receiver								
Mounting height, Transmitter								
Mounting height, Receiver								
TRANSMITTER								
Serial Number								
Supply Voltage (11 - 14 V)								
Channel selection (A – B – C – D)								
RECEIVER								
Serial Number								
Supply Voltage (11 - 14 V)								
Channel selection (A – B – C – D)								
Jumper ALIGN/LATCH – **NORMAL**								
Jumper **FAST**/SLOW								
SENSITIVITY setting (typ. **2/7**)								
HOLD IN time (typ. **min.**=0,5 s)								
ALIGN-level (RM82) (>0.1)								
SENS-level (RM82)								

At maintenance, troubleshooting and if replacing defect units it is recommended to check and update settings and values above

WAXING OF RADOMES								
Enter date: *Wax the Transmitter and Receiver radomes every 3 to 6 months. Use "Turtle clear vinyl top wax" or similar.*								

Date	Signature	**NOTES: Maintenance or other**

NCU

User's Guide

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CONTENTS

1 Revision History 3
2 Application 3
3 Abbreviations 3
4 References 3
5 Introduction 4
6 ASPGwy functions 4
6.1 Segment handling 4
6.1.1 Segment status 4
6.1.2 Command repetition 4
6.1.3 "No circuit power" handling 5
6.1.4 Command optimization 5
6.2 Adjacent lamp calculation 5
6.3 Sensor 5
6.4 Basic SCM communication 5
6.4.1 SCM synchronization 5
6.5 Redundancy in AspGwy 5
7 Asp communication 6
7.1 LMS Status View 6
7.1.1 Sort of information in status window 8
7.1.2 Reset of information in status window 8
7.1.3 Export of information from status window 8
7.2 SCM Status View 8
7.3 Sensor Status View 9
8 Host communication 10
8.1 Modbus View 10
8.1.1 View window of raw data sent/received 10
8.1.2 View window of data sent/received 11
9 Electrical and Mechanical Characteristics 12
10 Installation 13
10.1 Hardware installation 13
10.2 Software installation 13
10.2.1 Prepare for the NCU configuration 13
10.2.2 Installation 13
10.2.2.1 First time, no previous configuration 14
10.2.2.2 New update of the configuration 14
11 Maintenance 14
11.1 Yearly maintenance 14
11.2 Replacement 14

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comment*
SL	080121	-	First version
SL	090107	A	Added new Modbus view window.

2 APPLICATION

This document describes the NCU 591943 product from an operational perspective. It includes functionality, interface views, installation and maintenance.

Project specific information, like detailed interface protocol or detailed hardware installation drawings, are not described in this document, as they may vary from project to project.

3 ABBREVIATIONS

ASP	Airfield Smart Power
NCU	Network Concentrator Unit
AspGwy	Airfield Smart Power Gateway
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
SCM	Series Circuit Modem
PLC	Programmable Logic Controller
CCR	Constant Current Regulator
ATC	Air Traffic Control
ICAO	International Civil Aviation Organisation

4 REFERENCES

[1] SG591890-3023C ASP Modbus Interface

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5 INTRODUCTION

The purpose of the NCU is to provide a powerful interface to all the lights, sensors and miscellaneous equipment that are controlled and monitored by the ASP system. The NCU may be connected to different Host systems through a number of supported protocols.

The NCU comprises both the hardware (the computer) and the software run on it. The main application run on the NCU is the AspGwy. The AspGwy controls the interface between the NCU and the SCMs and it also processes the commands to be sent and receives the status from LMSs and SIUs.

Each component that is monitored and/or controlled through the NCU is defined as a separate ASP object. The different ASP objects offer basically three levels of abstraction for control and monitoring:

- Physical level; individual components installed in the system, LMS, SIU and SCM
- Logical level; control and monitoring abstractions which involve any number of physical units, light segment and sensor
- Complex logical level; powerful abstraction involving a number of logical abstractions, stopbar

6 ASPGWY FUNCTIONS

6.1 Segment handling

A segment is defined as a group of lamps controlled together. A segment can be divided over multiple SCMs.

A Segment is controlled by sending a "Group command" to a SCM.

6.1.1 Segment status

The SCM replies with the status of the lamps. A segment status is calculated on the basis of the lamps states in this segment. But since there are multiple lamps there can be multiple states. Calculating the segment status is not always straightforward. The default is that the segment is considered on when 100 % of the lamps are reporting ON or reporting lamp failure.

6.1.2 Command repetition

When a segment has lamps which is not in the correct state (ON/OFF) then the command to set the lamps in the correct state will be repeated a configurable number of times (default=3). If the lamp is still not reporting correct state the command repetition will drop to a lower configurable interval (default=2 minutes).

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6.1.3 “No circuit power” handling

When the AspGwy receives the No circuit power signal from the SCM it will set all the lamps as being off. If the segment is wanted off this is not a problem. But if the segment is wanted on this will result in a reference error. The Host system is responsible for handling eventual reference errors.

6.1.4 Command optimization

The AspGwy optimizes the command method used to get the most efficient way of communicating. This is depending on which and how many segments to send commands to. The optimization can not be used if flashing segments have to be updated.

6.2 Adjacent lamp calculation

The AspGwy include an adjacent lamp calculation algorithm. Information regarding adjacent lamp error is given within one segment. If information regarding adjacent lamps between segments is needed this has to be calculated in system logic at a higher level.

Segments controlled and/or monitored by two different NCUs (e.g in two substations) will not be evaluated for adjacent lamp error, this will be the responsibility of the Host system.

6.3 Sensor

The AspGwy can receive status signals from the field sensors connected to the ASP-system via SIU (e.g Microwave Barrier Detectors or Inductive Loop Sensors). Field sensors are typically used in stopbar systems to handle switching of interlocked stopbar- and taxiway centreline segments.

6.4 Basic SCM communication

The most fundamental part of the AspGwy is administrating the SCM communication - almost every other module will depend on this module. The physical interface for the SCM communication is a RS485 link between the NCU and SCM.

6.4.1 SCM synchronization

Under certain circumstances there is a risk for crosstalk between two or more circuits. As a method to overcome negative effects on the ASP system performance due to this, it is possible to let the AspGwy application synchronize the communication sequence in a pre-defined way.

6.5 Redundancy in AspGwy

It is possible and recommended to set up two NCUs for redundancy.

Handling the redundancy is using the fact that the NCU-SCM communication is already based on RS485, well suited for multidrop communication. Like a multi

drop setup it is possible to attach both NCUs to the same serial SCM communication line. As shown below.

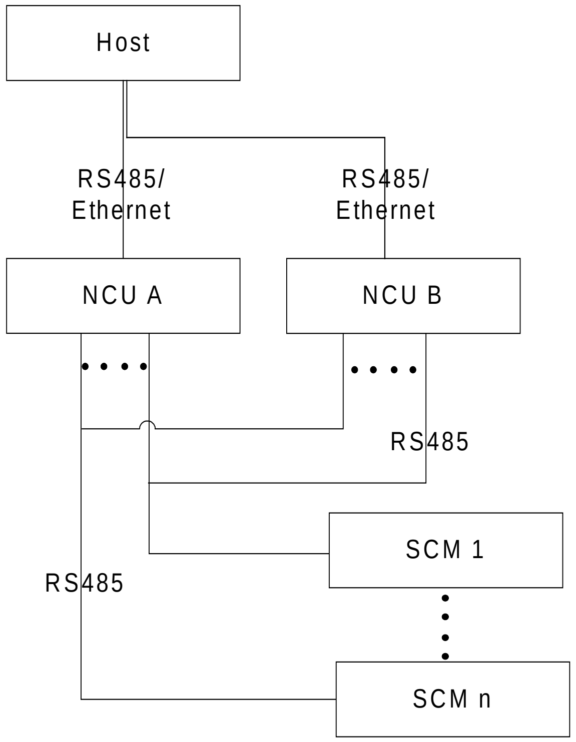
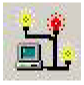


Figure 1 *Redundant NCU overview*

Any of the two NCUs can be active for any of the connected SCMs. The NCU-to-SCM switchover is done automatically depending on which one is first to establish connection with the SCM. Both NCUs read and receive status from the SCMs, i.e LMS and SIU states, hence both NCUs are ready to take over if the other fails.

7 ASP COMMUNICATION

When the application is running on the NCU you could see the little icon on the Task Tray of the computer.



When the AspGwy is opened (password protected) or configured for the specific site to be permanent open, you could see different views as; "LMS Status view", "SCM Status view" and "Sensor Status view". If they are not visible go to the menu "*View*" and then choose to open either one or all of these windows.

7.1 LMS Status View

In the LMS status window it is possible to see the status for each light/LMS which are controlled by the NCU.

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LMS Status view

ID	Segment	Seq Nr	Scm	Sync	TS	System Status	Faults	NoRef	Last Reply	Responce L...	Samp...	Fails	4 Fails	% Fails
TC34__A	LeadOn B4	0	TC6	3	2	Off	0	0	Off	63%	248	0	0	0%
TC35__A	LeadOn B4	1	TC6	3	3	Off	0	0	Off	63%	248	0	0	0%
TC36__A	LeadOn B4	2	TC6	3	4	Off	0	0	Off	63%	248	0	0	0%
TC37__A	LeadOn B4	3	TC6	3	5	Off	0	0	Off	63%	248	0	0	0%
TC38__A	LeadOn B4	4	TC6	3	6	Off	0	0	Off	63%	248	0	0	0%
TC39__A	LeadOn B4	5	TC6	3	7	Off	0	0	Off	63%	248	0	0	0%
TC40__A	TC B4-D11	0	TC6	3	8	On	0	0	On	63%	248	0	0	0%
TC41__A	TC B4-D11	1	TC6	3	9	On	0	0	On	63%	248	0	0	0%
TC42__A	TC B4-D11	2	TC6	3	10	On	0	0	On	63%	248	0	0	0%
TC43__A	TC B4-D11	3	TC6	3	11	On	0	0	On	63%	248	0	0	0%
TC44__A	TC B4-D11	4	TC6	3	12	On	0	0	On	63%	248	0	0	0%
TC45__A	TC B4-D11	5	TC6	3	13	On	0	0	On	63%	248	0	0	0%
TC1__A	TC B4-D11	6	TC6	3	14	Lamp Error	3	0	Lamp Fail	63%	248	49	12	19%
TC6__A	LeadOn D11	0	TC6	3	15	Off	0	0	Off	63%	248	0	0	0%
TC5__A	LeadOn D11	1	TC6	3	16	Off	0	0	Off	63%	248	0	0	0%
TC4__A	LeadOn D11	2	TC6	3	17	Off	0	0	Off	63%	248	0	0	0%
TC3__A	LeadOn D11	3	TC6	3	18	Off	0	0	Off	63%	248	0	0	0%
TC2__A	LeadOn D11	4	TC6	3	19	Error,Off	2	0	LMS Fail	0%	248	100	25	40%
TC39__B	LeadOff B4	0	TC6	4	7	On	0	0	On	63%	248	0	0	0%
TC38__B	LeadOff B4	1	TC6	4	6	On	0	0	On	63%	248	0	0	0%
TC37__B	LeadOff B4	2	TC6	4	5	On	0	0	On	63%	248	0	0	0%
TC36__B	LeadOff B4	3	TC6	4	4	On	0	0	On	63%	248	0	0	0%
TC35__B	LeadOff B4	4	TC6	4	3	On	0	0	On	63%	248	0	0	0%
TC34__B	LeadOff B4	5	TC6	4	2	On	0	0	On	63%	248	0	0	0%
TC1__B	TC D11-B4	0	TC6	4	14	On	0	0	On	63%	248	0	0	0%
TC45__B	TC D11-B4	1	TC6	4	13	On	0	0	On	63%	248	0	0	0%
TC44__B	TC D11-B4	2	TC6	4	12	On	0	0	On	63%	248	0	0	0%
TC43__B	TC D11-B4	3	TC6	4	11	On	0	0	On	63%	248	0	0	0%
TC42__B	TC D11-B4	4	TC6	4	10	On	0	0	On	63%	248	0	0	0%
TC41__B	TC D11-B4	5	TC6	4	9	On	0	0	On	63%	248	0	0	0%
TC40__B	TC D11-B4	6	TC6	4	8	On	0	0	On	63%	248	0	0	0%
TC2__B	LeadOff D11	0	TC6	4	19	On	0	0	On	63%	248	0	0	0%
TC3__B	LeadOff D11	1	TC6	4	18	Lamp Error	3	0	Lamp Fail	63%	248	102	25	41%
TC4__B	LeadOff D11	2	TC6	4	17	On	0	0	On	63%	248	0	0	0%
TC5__B	LeadOff D11	3	TC6	4	16	On	0	0	On	63%	248	0	0	0%
TC6__B	LeadOff D11	4	TC6	4	15	On	0	0	On	63%	248	0	0	0%

The information shown in the LMS status window is:

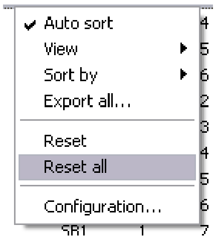
Column	Description
ID	Name on the light fixture and LMS
Segment	Name of the light segment to which the LMS belongs
Seq.Nr	The sequence number of the physical placement of the LMS in the segment
Scm	The SCM name to which the LMS belongs
Sync	The LMS sync used (part of the unique address on the circuit)
TS	The LMS time slot used (part of the unique address on the circuit)
System Status	Status on the light, reported to Host system (On, Off, Error, Lamp Error Communication Error)
Faults	N/A
NoRef	N/A
Last Reply	The last status reply from LMS (On, Off, Lamp Fail, LMS Fail)
Response Level	The response level of the physical signal from the LMS
Samples	The number of samples received since start of application or last reset of status window.
Fails	The amount of samples from the LMS which have responded fail.
# Fails	Number of fails which have been reported to the Host system. Note: # indicates how many samples from LMS must report fail, before it is sent up in the system. This is done to avoid reporting temporary disturbance on the circuit.
% Fails	Percentage of collected samples which have been reported fail.

7.1.1 Sort of information in status window

It is possible to sort the status information. Just click in the header with the mouse to choose according to which column to sort the information.

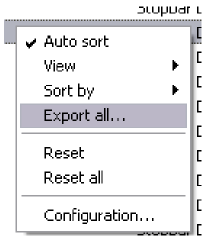
7.1.2 Reset of information in status window

To reset the collected information, and start counting the samples from scratch, right click with the mouse in the window and choose to either "Reset" (information for one LMS) or "Reset all" (information for all LMSes).



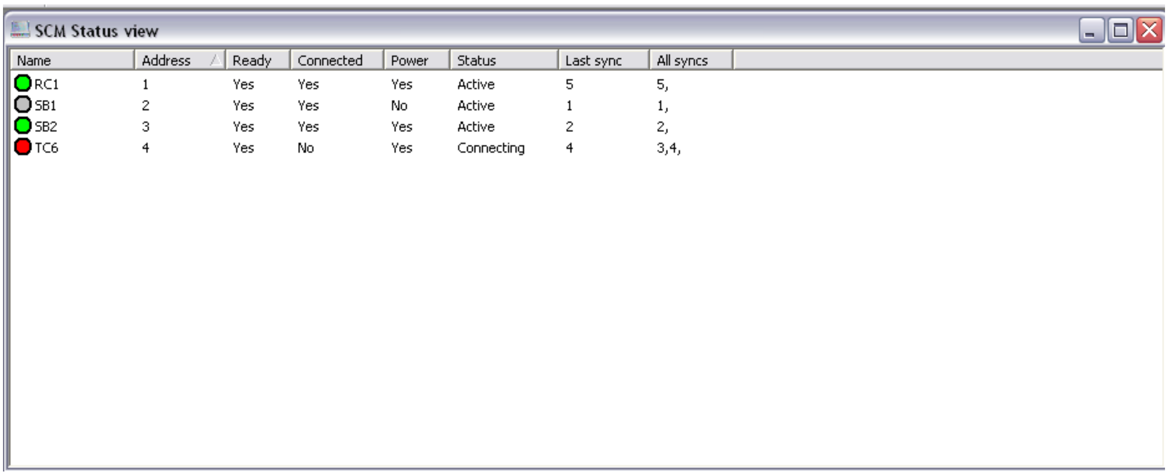
7.1.3 Export of information from status window

The collected status could be exported to a file. Right click in the window and choose "Export all.."



7.2 SCM Status View

In the SCM status window it is possible to see the status for each SCM which are controlled by the NCU.



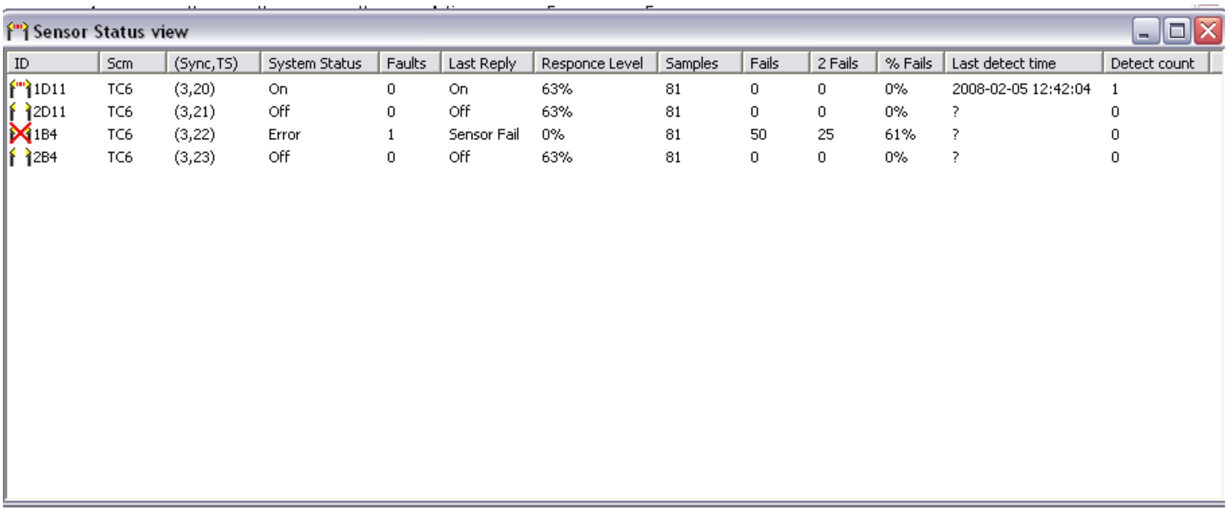
The information shown in the SCM status window is:

Column	Description
Name	Name of the SCM
Address	The modem address to the SCM
Ready	The indication that AspGwy is up and running
Connected	Information if it possible to communicate with the SCM
Power	Information if it is power or not in the circuit.
Status	The status of the AspGwy communication (Active, Connecting, Disconnected or Passive) Passive indicates that the SCM is controlled by another (redundant) NCU.
Last sync	The sync from which the information is last collected
All Syncs	States all syncs which are used by the SCM

The same possibilities, as for the LMS status window, apply for the SCM status window. You could sort, reset information and export collected status information.

7.3 Sensor Status View

In the Sensor status window it is possible to see the status for all Sensors which are controlled by the NCU.



ID	Scm	(Sync,TS)	System Status	Faults	Last Reply	Responce Level	Samples	Fails	2 Fails	% Fails	Last detect time	Detect count
1D11	TC6	(3,20)	On	0	On	63%	81	0	0	0%	2008-02-05 12:42:04	1
2D11	TC6	(3,21)	Off	0	Off	63%	81	0	0	0%	?	0
1B4	TC6	(3,22)	Error	1	Sensor Fail	0%	81	50	25	61%	?	0
2B4	TC6	(3,23)	Off	0	Off	63%	81	0	0	0%	?	0

The information shown in the Sensor status window is:

Column	Description
ID	Name on the sensor
Scm	The SCM name to which the sensor belongs
Sync, TS	The sync and time slot used (part of the unique address on the circuit)
System Status	Status on the sensor, reported to Host system (Off, On, Error)
Faults	N/A

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Last Reply	The last status reply from SIU (On, Off, Sensor Fail)
Response Level	The physical signal response level from the SIU
Samples	The number of samples received since start of application or last reset of status window.
Fails	The amount of samples from the SIU which have responded fail.
# Fails	Number of fails which have been reported to the Host system. Note: # indicates how many samples from SIU must report fail, before it is sent up in the system. This is done to avoid reporting temporary disturbance on the circuit.
% Fails	Percentage of collected samples which have been reported fail.
Last detect time	The time stamp for the last detect from the sensor
Detect count	The number of detect from the sensor

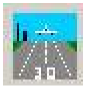
The same possibilities, as for the LMS status window, apply for the Sensor status window. You could sort, reset information and export collected status information.

8 HOST COMMUNICATION

The NCU supports a number of standard host communication protocols, of which the Modbus protocol is the most common.

8.1 Modbus View

When the application is running on the NCU you could see the little icon on the Task Tray of the computer.



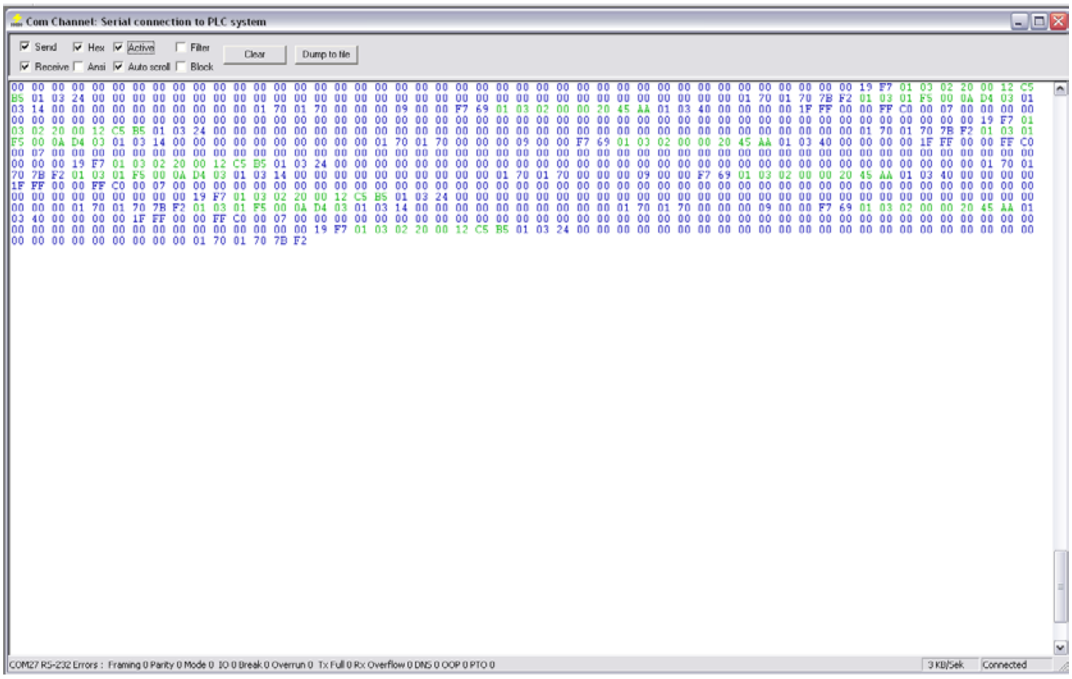
The window view to see the packages received and sent in the NCU via the Modbus interface are opened inside the ModbusGwy application. When the ModbusGwy is opened (password protected) or configured for the specific site to be permanent open.

For information regarding the Modbus Host Interface Communication see ref[1].

8.1.1 View window of raw data sent/received

Go to menu "View" and select "Com Channel..". In the pop up window select "connection to PLC system" and press the OK button.

The window view opened looks like the picture below.



In accordance with the Modbus protocol you could see the sent commands from the Host system (shown in green text) and the response from the NCU (shown in blue text).

In the Modbus view window it is possible to select:

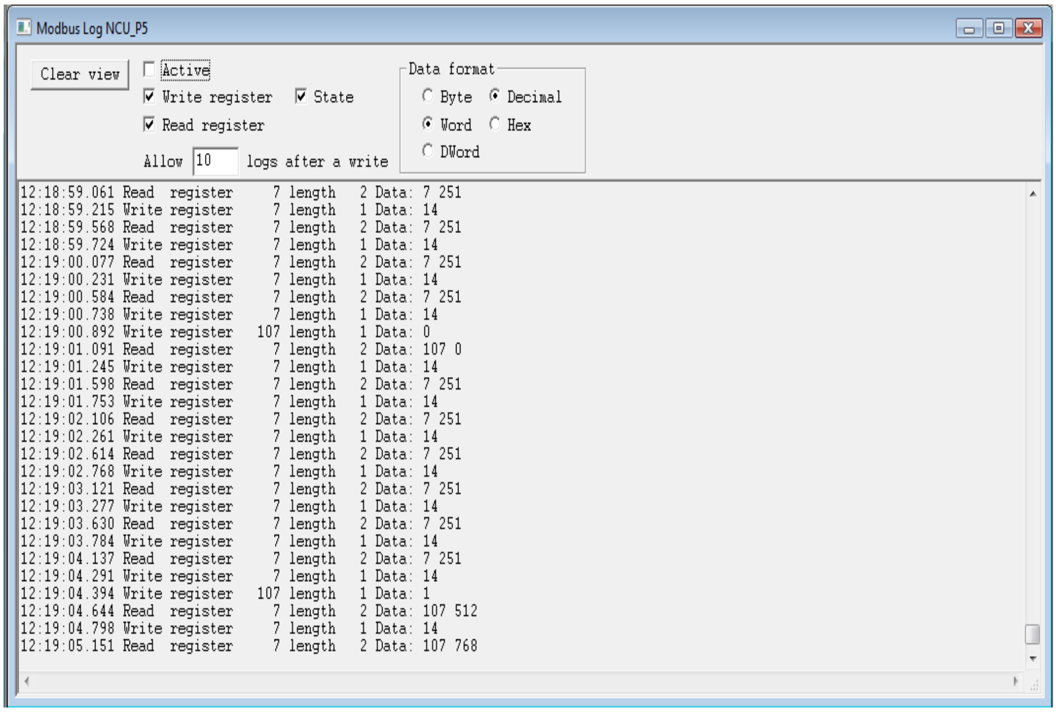
- Send; shows the data sent from the NCU to the Host
- Receive; shows the data sent from the Host to the NCU
- Active; when selected the data is continues written in the window. When not selected the data is no longer written in the window and it is possible to scroll in the window to see the old data.

The "Hex" and "Auto scroll" options should always be selected.

8.1.2 View window of data sent/received

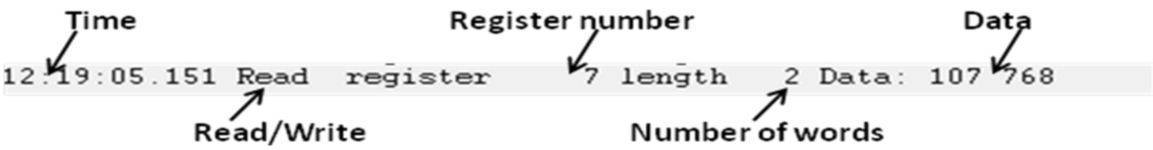
Go to menu "View" and select "Base IO..". In the pop up window select the name on the IO channel to show and press the OK button.

The window view opened looks like the picture below.



In accordance with the Modbus protocol you could see the read and write commands from the Host system and the response data.

Each line from the example above should be interpreted as:



In the Modbus view window it is possible to select:

- Write register; shows the data written to the NCU by the Host
- Read register; shows the data read from the NCU by the Host
- Active; when selected the data is continues written in the window. When not selected the data is no longer written in the window and it is possible to scroll in the window to see the old data.

It is possible to choose if the data should be presented in the view window as Decimal or Hexadecimal. It is also possible to choose if the data should be presented as bytes (8 bit), words (16 bit) or Dword (32 bit).

9 ELECTRICAL AND MECHANICAL CHARACTERISTICS

The electrical and mechanical characteristics for the NCU computer are described in the information included from the computer manufacturer or on their web site support.

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Interface specifications		
Interface to Host-System	Electrical	RS232C/485 or Ethernet
	Protocol	Modbus RTU and JBUS
		Siemens RK512/3964R
Interface to SCM	Electrical	RS232C/485
	Protocol	Safegate proprietary

10 INSTALLATION

10.1 Hardware installation

Depending on system configuration, the NCU connects to a number of SCMs for series circuit communication, and to the Host system.

Also depending on the system configuration and to support different electrical interface the NCU comes equipped with different types of added boards, e.g for Ethernet, RS485, Profibus.

For details on how the NCU should be installed refer to project specific installation drawings.

10.2 Software installation

For various reasons, the user may be requested by Safegate to update the NCU software or configuration.

10.2.1 Prepare for the NCU configuration

Unzip the received configuration and put the full structure on a USB-key. It is important that the folder structure is preserved since the configuration load program (SoftwareLoader) on the NCU computer is looking for updates on a specific path.

10.2.2 Installation

The program that loads the configuration to the NCU is in the C:\SafeControl directory and is called SoftwareLoader.exe.

10.2.2.1 First time, no previous configuration

Put the USB-key into one of the USB contacts on the front of the NCU. Double-click on the desktop icon  "Restart/Start NCU application", (which points at the file C:\SafeControl\SoftwareLoader.exe).

One other way to load the configuration is to restart the NCU computer, and then the SoftwareLoader will start up automatically and install the configuration from USB-key.

10.2.2.2 New update of the configuration

To load the update of the configuration into the NCU you first need to stop the applications running on the NCU. You do that by double-click on the desktop icon  "Terminate/Stop NCU application", (which points at the file C:\SafeControl\Terminate.cmd).

Now put the USB-key into one of the USB contacts on the front of the NCU. Double-click on the desktop icon "Restart/Start NCU application", (which points at the file C:\SafeControl\SoftwareLoader.exe).

11 MAINTENANCE

11.1 Yearly maintenance

- Ocular inspection
    - Check for damages or overheating
    - Check fans operating properly
    - Clean, remove dust
- Software configuration verification
    - Check configuration version
      Version information is found in the file "Version.tst" in the C:\SafeControl\ directory.

11.2 Replacement

A NCU with the specific site configuration is ordered from Safegate International AB to be a replacement or spare part for an existing NCU.

From	OH	Date	000511

Airfield Smart Power and power line communication

Power Line Communication

Communicating on the serial circuit power cable is not an easy task. A system designed for this type of communication must be capable of dealing with for example:

- cross talk between circuits, applies to both shielded and unshielded cable,
- varying electrical conditions (imposed by for example different types of CCRs, isolation transformers, series circuit cable and layout),
- ageing of both the serial circuit cable and the isolation transformers,
- etc.

Our experience tells us that a system capable of dealing with the above may not be designed solely in a controlled environment such as a lab, based on theoretical assumptions. On the contrary, the key to good functionality is numerous field tests performed under varying conditions regarding series circuit size, layout, age etc. One could say that *it is fairly simple to get one circuit to work reliably, the tricky part is to get a large number of circuits to work on each and every one of a number of different airports*.

The ASP-system is put to the test every time it's installed and so far it's been installed for operational use at more than 30 different airports world-wide.

Installation Requirements

There are systems on the market today which demand specific installation requirements to be met, for example:

1. Primary cable where the shield is assumed to be available for communication.
2. Isolation transformer which support connection of the cable shield in a way which makes it possible to use the shield for communication. This may either require special connectors and/or limit the selection of isolation transformer to a very small number.
3. The shield must only be grounded in the substation for the communication to work properly.

Work is in progress to establish international standards for personal safety in dealing with series circuits. System permitting only one ground point for each series circuit may come in conflict with personal safety requirements and hence with these future standards. This is also true for systems which require the secondary of the isolation transformer to be either grounded or not.

ASP® System Flexibility

Today, the Safegate ASP System is in operational use at more than 30 airports world-wide. The system has been developed to work under much varying conditions. This implies that:

1. The Safegate ASP-system may be used on shielded as well as unshielded cables. There are no constraints when it comes to grounding the shield since it's not used by the system.
2. The Safegate ASP-system supports both grounded secondary on the isolation transformer and floating secondary.
3. The Safegate ASP-system is compatible with all FAA-compliant isolation transformers.
4. The Safegate ASP-system does not require any non-standard procedures, cable arrangements or other equipment during installation on the series circuit.

The ASP-system's electrical requirements on a series circuit level are the same as a light fitting's or an isolation transformer's[1]. Thereby the ASP-system does not put any additional constraints on how the installation is done and hence there is no conflict with for example electrical safety code and general or local standards when installing this type of system.
The ASP-system in not only designed with the above in mind. It has been installed in large number of airports world-wide, every one with it's own set of unique prerequisites in terms of electrical conditions, field hardware etc. This confirms that the ASP-system truly works according to design objectives.

Availability

The series circuit cable transfers power to the lamp on the circuit and the same physical channel is used by the ASP-system for communication. This implies that whenever there is power available to the lamps, the ASP-system will have access to its communications channel and control and monitoring will be available. A discontinuity on the cable shield will not normally influence either the light's or the ASP-system's availability.

This is not true for a system that uses the shield (or a separate control cable) as a communications channel. In case the shield breaks lights might be available (when current is allowed to flow in the circuit) but the system will not, implying that no control or monitoring will be possible.

[1] Safegate has a set of general recommendation or preferences regarding for example cable routing which may be applied in case a new series circuit is to be designed.

ASP System

International Standards Compliancy List

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CONTENTS

1 Revision History 3
2 Scope 3
3 Application 3
4 Compliancy List 4

1 REVISION HISTORY

Ver	Date	Remark	Author
0.1	020128	Document created, draft.	JF

2 SCOPE

This document lists international standards that Safegate ASP system comply with.

3 APPLICATION

This document applies to Safegate ASP system.

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4 COMPLIANCY LIST

Standard	Status	Comments
SS-EN ISO 9001:1994	Complies	-
EMC directive for generic emission standard EN 50 081-1:1992	Complies	-
EMC directive for generic immunity standard EN 50 082-2:1995	Complies	-
ICAO Aerodromes Annex 14	Complies	-
ICAO Aerodrome Design Manual Part 4 Visual Aids 9157-AN/901	Complies	-
ICAO Manual On SMGCS 9476-AN/927	Complies	A SMGCS (Surface Movement Guidance and Control System) is a subset of an A-SMGCS (Advanced Surface Movement Guidance and Control System). An A-SMGCS consist of many modules, e.g. • Vehicle surveillance
ICAO Manual On A-SMGCS Draft		

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Standard	Status	Comments
FAA Advisory Circular on SMGCS AC120-57A		• Vehicle separation • Vehicle identification • Routing • Guidance and control All these modules can only by realized by different kinds of system working together, e.g. • SLC system (Single Lamp Control) • SMR system (Surface Movement Radar) • RTF system (Radiotelephony) • MET system (Meteorological) • ATM system (Air Traffic Management) Therefore, a standalone Single Lamp Control System cannot be fully compliant with all modules, but the Safegate ASP-system is compliant with the modules that can be related to control of the airfield lamps, e.g. • Routing • Guidance and control
FAA Advisory Circular on Low Visibility Taxiway Lighting Systems AC150/5340-28	Complies	Chapter 8.g.(2)(e) – Failure modes of In-pavement RGL's. The synchronization between RGL's is based on that the communication between SCM and LMS's is intact, so that the SCM can send synchronization signals to the LMS's. Each LMS also has an internal synchronization that will keep the RGL's synchronized in case of communication failure. Therefore, it can be anticipated that in most working conditions the synchronization will be maintained even at control system communication failure.

Case Description
Turn-key ASP

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Contents

1 Revision History ... 3
2 Scope ... 3
3 Abbreviations ... 3
4 References ... 3
5 Introduction ... 4
5.1 System Overview ... 4
6 The ASP System ... 4
6.1 System Components ... 4
6.2 Physical Design ... 4
6.3 Function ... 4
6.3.1 Power On ... 5
6.3.2 Safe State ... 5
6.4 Configuration ... 5
6.5 Installation ... 5
6.5.1 LMS ... 6
6.5.2 SCM ... 6
6.5.3 SCF ... 7
6.5.4 Control System Interface ... 7
6.5.4.1 SCM Control Inputs ... 8
6.5.4.2 SCM Alarm Outputs ... 8
6.5.4.3 Control Logic ... 8
6.5.4.4 Alarm Criteria ... 8
6.5.4.5 Alarm Logic ... 9
6.5.4.6 Response Times ... 9
6.6 Maintenance ... 9
6.7 Spare Parts ... 9
6.8 Trouble Shooting ... 10
7 Support ... 10

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comment*
OH	021123	1.0	Document created.

2 SCOPE

This document describes a Turn-key ASP system. The system described has been delivered, installed, commissioned and accepted in Sweden 2002. Since this document is created in order to describe the system concept as such the site is not referenced by actual name but simply denoted *The Site*.

The document is based on the original Swedish system description for the commercial system.

3 ABBREVIATIONS

ASP®	Airfield Smart Power
LMS	Light Monitor and Switch Unit
SCM	Series Circuit Modem
SCF	Series Circuit Filter
CCR	Constant Current Regulator
UPS	Uninterruptible Power Supply
RWY	RunWaY

4 REFERENCES

More detailed information on ASP products, their characteristics and handling can be found in product leaflets and/or user guides.

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5 INTRODUCTION

5.1 System Overview

The ASP System for the Site is configured to enable switching between two different RWY-configurations. One is used by the air force and the other by commercial airlines. Light functions involved when switching from one configuration to the other include threshold lights and RWY-edge lights. These lights add up to 156 and are distributed on two series circuits, a so called interleaved configuration.

The ASP System not only controls the switching but also monitors all threshold and RWY-edge lights.

6 THE ASP SYSTEM

6.1 System Components

The ASP System for the Site consists hardware-wise of:

- 156 LMS
- 2 SCM
- 2 SCF (mounted inside the CCRs)

In addition isolation transformers for connecting the SCMs to the series circuit and interfacing material for interfacing the SCMs to the control system (see also 6.5.4) is included in the package.

6.2 Physical Design

Each of the two SCMs are located in a separate sub station, one at one end of the RWY, the other at the other end.

There are two circuits supplying the 156 RWY-edge and threshold lights. The lights are evenly distributed between the circuits and the circuit layout is designed for interleaved configuration. Hence there are 78 lights equipped with LMSs on each circuit.

The SCM is connected to the existing control system using potential free contacts for both control input and alarm indication (output).

6.3 Function

The ASP System supports control and monitoring of five different light functions: *air force RWY-edge, mixed RWY-edge, commercial threshold 14, air force threshold 14* and *air force threshold 32*. The two RWY-configurations are denoted AIRFORCE (AF) and COMMERCIAL (COM) respectively.

Light Function	AF	COM	REMARK

Light Function	AF	COM	REMARK
AF RWY-edge	ON	OFF	Lights B61-B84
Mixed RWY-edge	ON	ON	Lights B19-B60, always ON
COM threshold 14	OFF	ON	Lights TR201-TR218
AF threshold 14	ON	OFF	Lights TR85-TR102
AF threshold 32	ON	ON	Lights TR1-TR18, always ON

Every light is monitored individually and the SCM continuously concatenates system status and if the configured alarm criterion is met an alarm is indicated.

6.3.1 Power On

When the system is activated, i.e. when the current level in the series circuit rises above what's required by the LMSs to power up (minimum 2.5 A_{RMS}), the AIRFORCE RWY-configuration will result if no command indicating differently is available from the control system.

If the control system output to the SCMs dictates COMMERCIAL RWY-configuration, the switchover will occur as soon as SCMs have established communication with LMSs on the series circuit.

6.3.2 Safe State

If the SCM fails to establish communication with LMSs the AF RWY-configuration will result.

If SCM to LMS communication breaks down, LMSs are configured to maintain the RWY-configuration last commanded.

Finally, if communication between SCM and control system is lost, the SCM may be configured to assert any of the two RWY-configurations or maintain the last commanded.

6.4 Configuration

The system is configurable in terms of (among other things):

- Number of lights serviced, i.e. controlled and monitored.
- Power up state for all lights equipped with LMS.
- Safe State for all lights in the system.
- Alarm criteria.

All equipped is delivered pre-configured but modification can be made on site any time which include possible future expansion of the system.

6.5 Installation

The LMS is installed in the field while SCM and SCF are installled where the CCRs are located.

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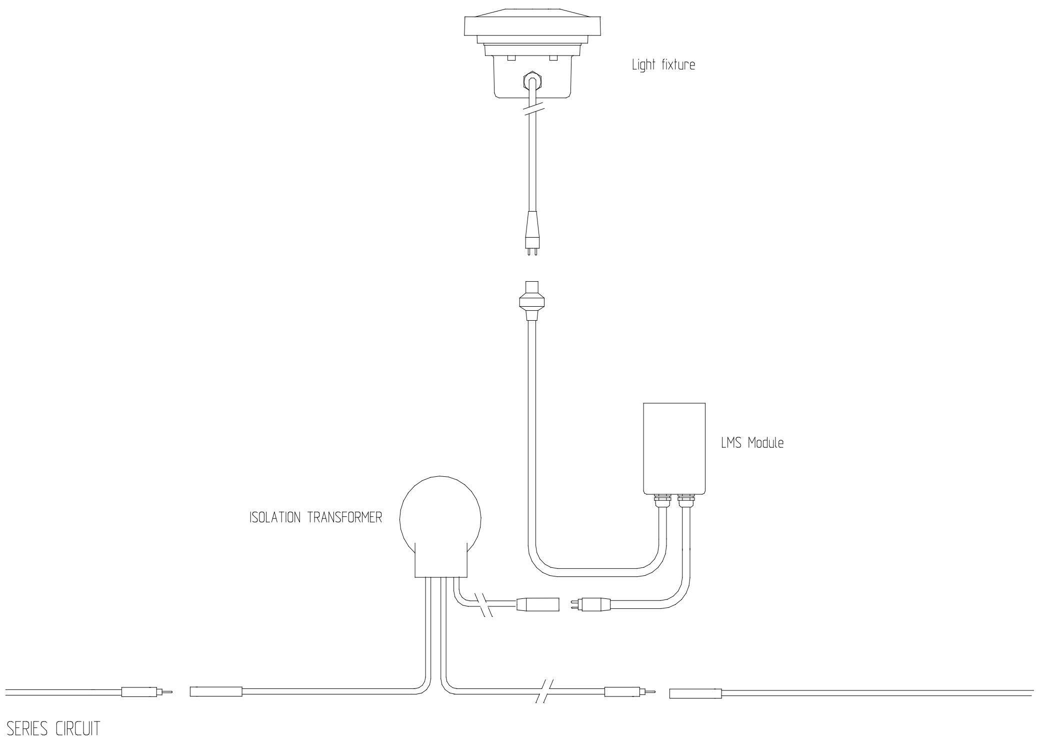
6.5.1 LMS

The LMS is installed between the lights and the isolation transformer as indicated by the figure below. Note that the isolation transformer rating may be affected if long lamp cables are used.

<u>Every LMS is labelled and the label bears the same marking as the light to which it should be connected. For the system to operate as designed, it's most important that LMSs are installed in the right locations</u>.



The LMS module is connected to secondary side of isolation transformer

6.5.2 SCM

The SCM is connected to the series circuit via a 200W isolation transformer. It's recommended that the SCM is connected to the mains through an UPS.

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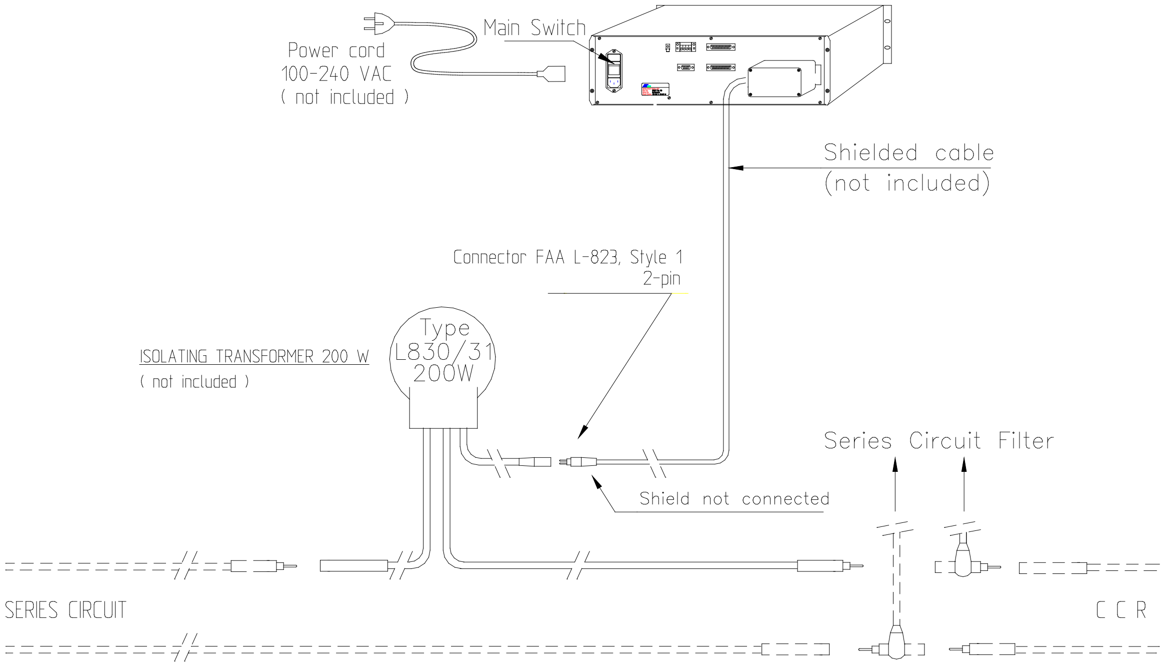
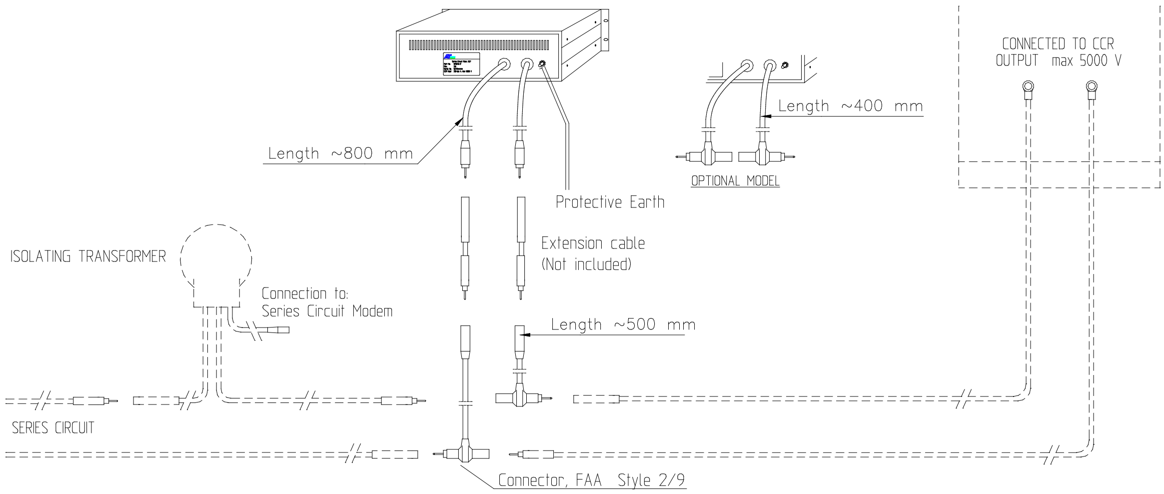


6.5.3 SCF

The SCF connects to the series ciruit according to the figure below. Note that the SCF is connected to the primary cable directly on the CCR outputs.

The SCF may either be mounted outside the CCR (encapsulated) or un-encapsulated inside the CCR.



6.5.4 Control System Interface

The interface to the control system is through relays to and from the SCM's digital I/O (two 25-pole DSUB connectors on the back-side of the SCM).

6.5.4.1 SCM Control Inputs

Control signals from the control system are connected to the SCM connector marked DIG/ANA-IN.

Function	Pins	Remark
Input1, COM (RWY-configuration)	1, 14	Potential free contact closure
Input2, AF (RWY-configuration)	2, 15	Potential free contact closure

6.5.4.2 SCM Alarm Outputs

Alarm outputs from the SCM are availble through the connector marked DIG OUT.

Function	Pins	Remark
Output1, lamp failure	9, 22	Potential free contact, max 500mA, 100VDC
Output2, system failure	10, 23	Potential free contact, max 500mA, 100VDC

6.5.4.3 Control Logic

Control logic according to the table below:

Input	State	Status	Remark
COM	Closed	Not defined	No change of RWY-configuration
AF	Closed		
COM	Open	Commercial RWY-configuration selected	Switch RWY-configuration if current configuration is AF
AF	Closed		
COM	Closed	Air Force RWY-configuration selected	Switch RWY-configuration if current configuration is COM
AF	Open		
COM	Open	Not valid	Equivalent to no connection between SCM and control system. SCM will activate system alarm output. RWY-configuration not affected.
AF	Open		

The SCM scans the control inputs with a frequency of 100 Hz and debounce the input signals. For the SCM to acknowledge an input signal change the signal will have to be stable for at least 100 ms.

6.5.4.4 Alarm Criteria

Normally the system is configured to output a lamp failure alarm when at least one failed lamp is detected. However the lamp failure alarm crititrion is configurable between one and 15 lamps.

System alarm is activated if/when:

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- No connection with the control system is detected (see table above).
- If switch to selected RWY-configuration cannot be completed, i.e. if there is a mismatch between selected configuration and actual configuration.
- If SCM breaks down.

6.5.4.5 Alarm Logic

An open alarm output indicates alarm while a closed ditto indicates the absence of an alarm. The table below summarizes the alarm logic:

Circuit Status	System Status	Lamp Alarm	System Alarm	Remark
Current in circuit below 2.5 A_{RMS}	System OK	Closed	Closed	No current in series circuit[1]
	System failure	-	Open	No current in series circuit
Current in circuit above 2.5 A_{RMS}	System OK, no lamp failures detected	Closed	Closed	Series ciruit energized
	System OK, lamp failure detected and above configured threshold[2]	Open	Closed	Series ciruit energized
	System failure	-	Open	Series ciruit energized

Note that the LEDs on the front panel of the SCM indicate status of the two alarm outputs where a green LED is equivalent to the absence of an alarm.

6.5.4.6 Response Times

From the point in time when the SCM has acknowledged an input signal change indicating a change in RWY-configuration from AF to COM or vice versa, a maximum of two seconds will elapse before commands have been transmitted to all LMSs and verification of command acceptance have been completed.

Lamp failures are detected within five seconds from the point in time when the lamp filament actually breaks. When a broken lamp is replaced, the lamp failure alarm output is reset automatically in case the failure criterion is not met any more.

6.6 Maintenance

Normally, no preventive maintenance is necessary.

6.7 Spare Parts

The standard ASP System components: LMS, SCM and SCF with which the system is build are the only spare parts applicable.

[1] Lamp status is not monitored when circuit is de-energized and hence no lamp failure alarm.
[2] Larm failure criterion is configurable, see section 6.5.4.3.

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6.8 Trouble Shooting

Basic trouble shooting according to table below. For additional assistance when needed contact support (section 7).

Symptom	**Cause**	**Action**
Lamp OFF	Broken lamp	Replace lamp
Lamp OFF even after replacement	Broken LMS	Replace LMS
…		

7 SUPPORT

Safegate International AB's support is 24/7. Call 040 699 1740, send a fax to 040 699 1745 or an e-mail to support@safegate.com.

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ASP System

ASP Modbus Interface

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CONTENTS

1 Revision History ... 3
2 Scope ... 3
3 Application ... 3
4 Extended functions ... 3
5 Interface Protocol ... 4
5.1 Modbus Protocol Details ... 4
5.2 Initialization and Failsafe ... 4
5.3 Modbus Frame ... 4
5.4 Command and Status Details ... 6
5.4.1 NCU Status word ... 6
5.4.2 Heart Beat Words ... 6
5.4.3 SCM ... 6
5.4.3.1 SCM Communication error ... 7
5.4.3.2 SCM Circuit power off ... 7
5.4.4 Segment ... 7
5.4.4.1 Segment Command ... 7
5.4.4.2 Segment State ... 7
5.4.5 Sensor ... 8
5.4.5.1 Sensor State ... 8
5.4.5.2 Sensor Error ... 8
5.4.6 Lamp & LMS ... 8
5.4.6.1 Command ... 8
5.4.6.2 Lamp State ... 8
5.4.6.3 Lamp Error ... 9
5.4.6.4 LMS Error ... 9
APPENDIX A - STOPBAR ... 10
1 Stopbar ... 10
1.1 Stopbar Command ... 14
1.2 Stopbar Status ... 14
1.3 Stop bar error indication ... 15
1.3.1 Stopbar Segment Number of lamp in error ... 15
1.3.2 Stopbar Segment Adjacent Error ... 15
APPENDIX B – ADVANCED SEGMENT FUNCTIONS ... 16
1 Light Segment functions ... 16
1.1 Segment Lamp fail ... 16
1.2 Segment Adjacent Error ... 16
APPENDIX C – 2A intensity control ... 17
1 Intensity control ... 17
1.1 Intensity Group Command ... 17
1.2 Lamp Intensity Failure ... 18

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1 REVISION HISTORY

Author	*Date*	*Version*	*Comment*
JF	060901	A	Initial revision
SL	070418	B	Included logotype
LVL	070514	C	Updated with appendix
SL	080218	D	Updated naming of ASP status objects.
LVL/SL	080523	E	Revise of possible functions to use.
ÅP	081217	F	Editorial
SL/KN	100308	G	Added appendix for 2A intensity control.
BH/SL	100615	H	Updated Lamp Intensity Failure section

2 SCOPE

This document provides information about status and control data details for each type of ASP equipment provided in the Modbus Interface.

3 APPLICATION

This document describes the interface details between the ASP and the host system at airport. The specific interface memory bitmaps for a project can be found in a separate document describing the Wordbit table.

4 EXTENDED FUNCTIONS

The basic functions include SCM, Sensor, Segment Control, Segment Status and Lamp Status.

Besides these basic functions some extended functions can be included as options. These functions will be described in the appendixes:

Appendix A – Stopbar

Appendix B – General Light Systems

Appendix C – 2A intensity control

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5 INTERFACE PROTOCOL

5.1 Modbus Protocol Details

The host to NCU interface is based on Modbus RTU. Safegate supports both Serial and Ethernet implementations.
Serial parameters are: RS-232 (or RS-485):

- Baudrate 9600 (up to 115200)
- 8 data bits
- Even parity
- 1 stop bit.
- The NCU will be slave (server) and the HOST system will be the master (client).
- The HOST system shall typically use Slave Address 1 (configurable) when communicating with the NCU.

Ethernet parameters are:

- IP Address (to be decided)
- Port 502 (changeable)

The HOST system will poll the NCU at periodic interval to read the status of all equipment.

5.2 Initialization and Failsafe

In projects where the HOST system performs control (and not just monitoring) the NCU expects the Host system to cyclic perform the control.

The NCU will enter Failsafe mode programmed in LMS if the HOST system stops the write request.

Segment commands (on or off) must be sent to NCU when connection is established with NCU before Failsafe is removed.

5.3 Modbus Frame

Below is a description of the Modbus Protocol for Serial interface. The protocol is similar in the TCP version except that a 7 byte header is added and the CRC is not used.

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Read Request:

Field Name	*Example (Hex)*
Slave Address	01
Function	03
Starting Address HI	00
Starting Address LO	64
No. of Registers HI	00
No. of Registers LO	40
CRC	xx

Read Response:

Field Name	*Example (Hex)*
Slave Address	01
Function	03
Byte count	80
Data HI	xx
Data LO	xx
Data Hi	xx
Data LO	xx
.. (repeated for remaining bytes)	
CRC	xx

Write request:

Field Name	*Example (Hex)*
Slave Address	01
Function	10
Starting Address HI	00
Starting Address LO	01
No. of Registers HI	00
No. of Registers LO	01
Byte count	02
Data HI	xx
Data LO	xx
CRC	xx

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Write Response:

Field Name	*Example (Hex)*
Slave Address	01
Function	10
Starting Address HI	00
Starting Address LO	01
No. of Registers HI	00
No. of Registers LO	01
CRC	xx

5.4 Command and Status Details

5.4.1 NCU Status word

Status bit value	Indication	Description
0	NCU OK	NCU ok. Data valid.
1	NCU Fail	Internal error in NCU.

The NCU status word, bit 0 should be read to ensure that received data is valid!
Only if bit 0 = 0, the beneath information is valid!

5.4.2 Heart Beat Words

Command Word Loopback	Indication	Description
0..65535	NCU Alive	Can be used by Host System to implement Heart beat signal

The Host system shall be able to detect if the NCU responds.

The NCU Heart Beat Command word will by internal loopback be indicated in NCU Heart Beat Status word. Host system can use this to implement a Heart Beat by value.

Note: If the Host system can detect from its Modbus Client, whether the NCU is responding to the Modbus polls, then such a signal can be used as an alternative way for determining if the NCU is Alive.

5.4.3 SCM

The Serial Circuit Modem can provide status of its operation

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5.4.3.1 SCM Communication error

Error bit value	Indication	Description
0	OK	The SCM is communicating OK.
1	SCM communication failure	The SCM is not communicating with the NCU. The cause may be one or more of the following events: • It has failed its internal diagnostics • It has suffered an internal or external power failure • It has been switched to "Local" mode • The link between the SCM and the NCU has been cut or disconnected

Note: During SCM communication error the LMS will physical enter Failsafe state. However the LMS status reported to the host system will be unchanged.

5.4.3.2 SCM Circuit power off

Circuit power off bit value	Indication	Description
0	Circuit power ON	The series circuit is powered ON.
1	Circuit power OFF	The SCM has detected that the series circuit power is OFF. The cause may be one or more of the following events: • The CCR has been turned OFF • The CCR has failed, and thus been turned OFF • The connection between the SCM and its isolation transformer on the series circuit has been cut or disconnected, either internally or externally. **NOTE:** This is the ONLY notification that is given for this potential error, as the LMS will not signal an error in this situation

Note: When Circuit power off is set the Segment state and Lamp state changes to off for units on corresponding circuit.

5.4.4 Segment

5.4.4.1 Segment Command

The Segment Command is used in projects where the HOST system performs control of segments.

Command bit value	Command	Description
0	OFF	Command a segment OFF
1	ON	Command a segment ON

The Segment command bit defines the commanded state for the associated segment. Host System can both write and read command state.

5.4.4.2 Segment State

State bit value	State	Description
0	OFF	The segment is OFF
1	ON	The segment is ON

The Segment state bit will depend upon the setting of Back Indication.

Default back indication will be "True feedback". In this mode the State bit will be updated when ever all LMS (without error or lamp fault) has indicated their correct state.

If back indication is set to a percentage then the state bit will be updated as soon as enough LMS has reported back correct state.

If back indication is set to "First LMS", the state bit will be updated as soon as the first LMS reports correct state.

Note: The segment state can be used for On/Off animation on the host system. However if the Host system want to apply a segment fault animation, then it will be up to the Host system to deem segments in error, based upon the reported LMS Errors and the rules that apply in the specific airport.

5.4.5 Sensor

The Sensors can provide status of their operation

5.4.5.1 Sensor State

State bit value	Indication	Description
0	No detect	
1	Detect	

NOTE: If the series circuit power, i.e. the CCR, is turned OFF, the NCU will set the sensor status to No detect.

5.4.5.2 Sensor Error

Error bit value	Indication	Description
0	OK	The sensor is working correctly.
1	Sensor failure	The sensor is broken or disconnected.

NOTE: If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the sensor error information at least until the series circuit power is turned ON, or the NCU is rebooted.

5.4.6 Lamp & LMS

The lamp/LMS error information could be combined, one bit used to indicated lamp or LMS error, or separated, lamp error and LMS error are reported separately in two different bits. The standard if nothing is specified is to separate these two errors.

5.4.6.1 Command

Control of individual LMS has not yet been implemented in the Modbus Interface. In order to turn on/off lamps segment controls must be issued.

5.4.6.2 Lamp State

State bit value	Indication	Description
0	OFF	The lamp is OFF.
1	ON	The lamp is ON.

NOTE: If the series circuit power, i.e. the CCR, is turned OFF, the NCU will set the LMS status to OFF. The only exception are LMS's with either Error or Lamp fail which will retain their status information at least until the series circuit power is turned ON, or the NCU is rebooted.

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5.4.6.3 Lamp Error

Error bit value	Indication	Description
0	OK	The lamp is working correctly.
1	Lamp failure	The lamp is broken or disconnected.

NOTE: If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the lamp error information at least until the series circuit power is turned ON, or the NCU is rebooted.

5.4.6.4 LMS Error

Error bit value	Indication	Description
0	OK	LMS is working correctly.
1	LMS failure	LMS is broken or disconnected.

NOTE: If the series circuit power, i.e. the CCR, is turned OFF, the NCU will retain the LMS error information at least until the series circuit power is turned ON, or the NCU is rebooted.

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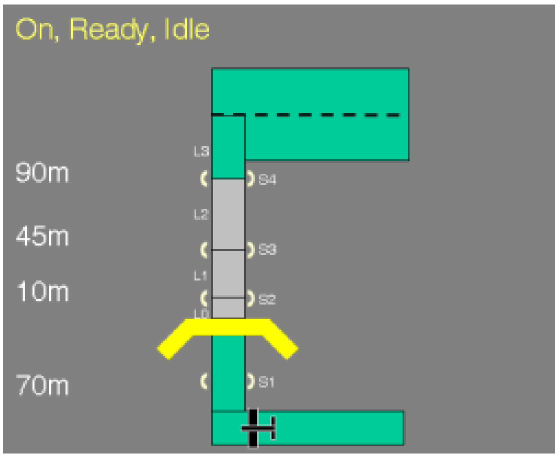
APPENDIX A - STOPBAR

1 STOPBAR

As an option it is possible to configure a stop bar functionality in the interface. Below is a description of the essentials in the Stop bar model.



Up to 4 sensors can be configured.

The first sensor in the model S1 will be the presence sensor. Ideal placement for this sensor is approximately 70m in front of the sensor, so that an airplane waiting at the Stopbar has passed the sensor.

The second sensor S2 will be controlling the re-lighting of the stop bar and turn off Lead On segment L0. In lack of this sensor the stopbar model will use a timer T1. This sensor will also be used for Incursion detection in case an airplane crosses a lit stopbar towards the runway. Ideal placement for this sensor is right behind the stopbar.

S3 turns off Lead On segment L1. In lack of this sensor the stopbar model will use a timer T2.

S4 turns off Lead On segment L2. In lack of this sensor the stopbar model will use a timer T3

L3 is a fixed segment that runs to the end of the Lead On TCL into the runway.

In most cases the actual Stop bar applications at an airport will only have a subset of the described sensors and Lead on segment. But even then the model can he used as not all the sensors and Lead On in the model need to be configured. The table below shows some of the possible applications where the model can be used.

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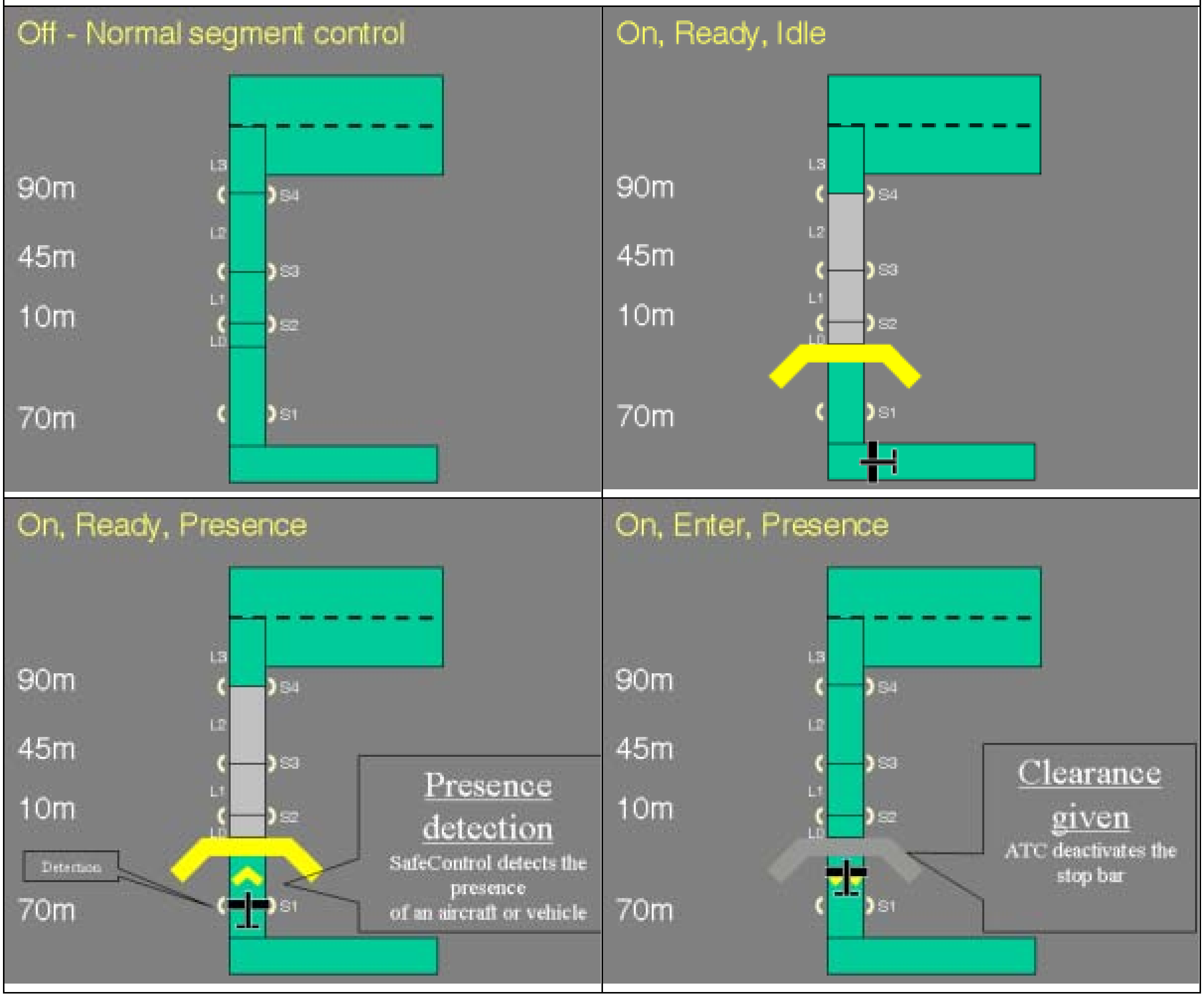
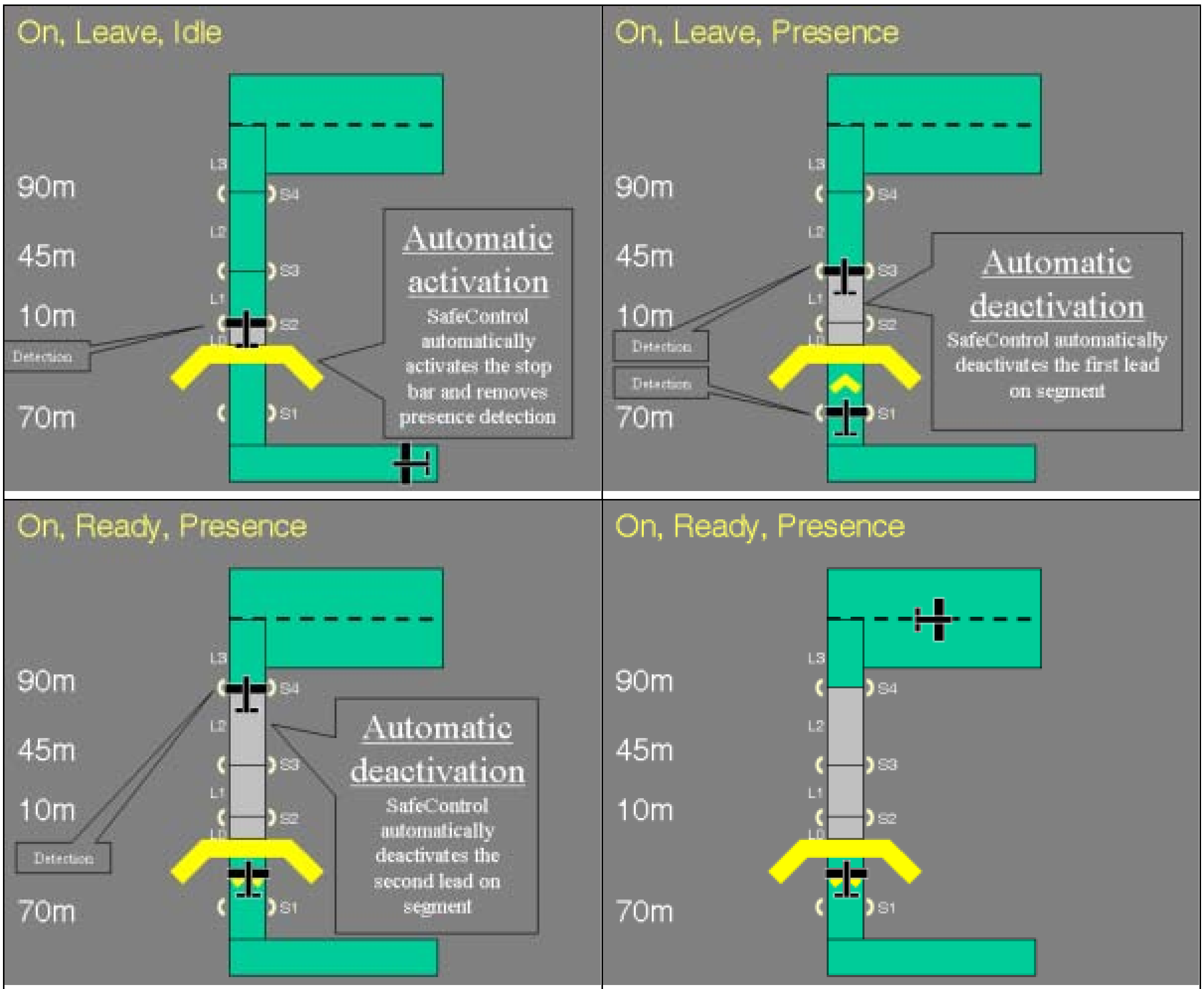
x = Includes Oi = Option 1, 2, … Ai = Alternative 1, 2, …	Stopbar Segment	90m Lead On	45/50m Lead On	2nd Lead On 45/50-90 m behind Stop Bar	2nd Lead On Extended to Runway	3rd Lead On Extended to Runway	Timer Stopbar + 1st Lead On	Timer Stopbar	Timer Lead On 1	Timer Lead On 2	Sensor 70m infront of Stopbar	Sensor Right behind Stopbar	Sensor at 90m	Sensor at 45/50m	Runway Incursion Detection	Remark
ICAO Basic	x	x					x						O1			
ICAO Standard	x	x						x	x		x	x	x		O1	
FAA Standard	x		x	A1	A2		x			x				x		A1 and A2 are two alternatives
SG Fast w. Presence	x		x	x		x		x	x	x	x	x		O1	x	Length of 1st Lead On can vary

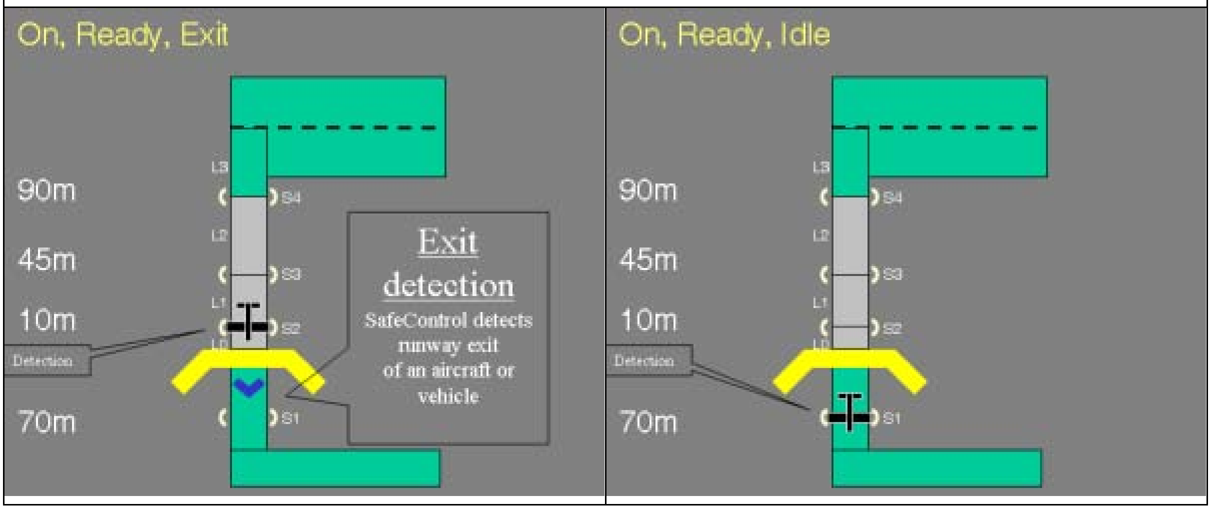
The pictures below illustrate the used notations.
The Stopbar can be: On or Off.
The Stopbar State can be: Ready, Enter or Leave.
The Aircraft incursion detection can be: Idle, Presence or Exit

Departures

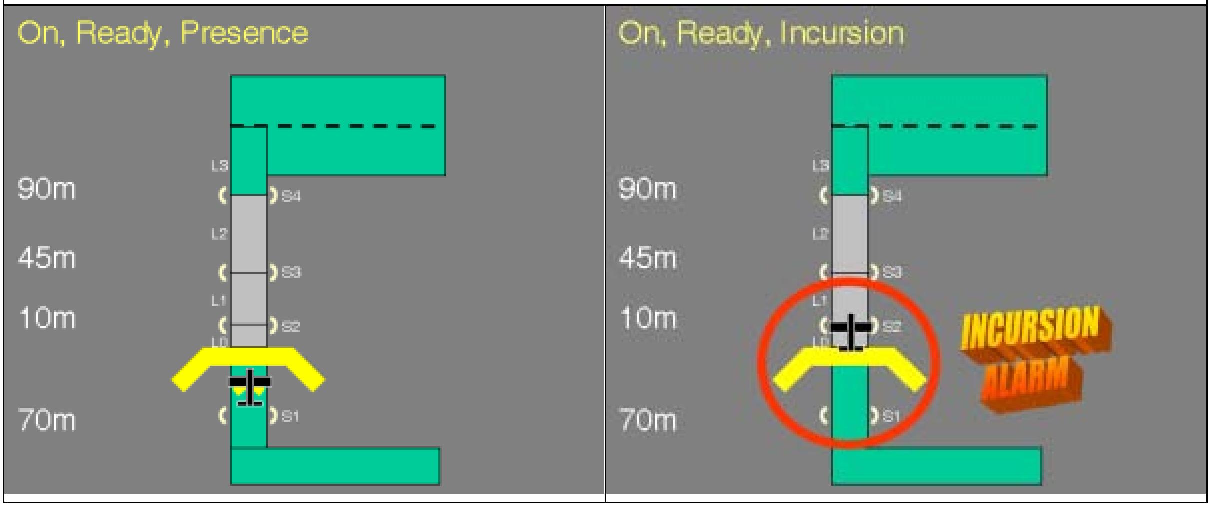



On, Leave, Idle
90m
45m
10m
70m
L3
L2
L1
L0
S4
S3
S2
S1
Detection
Automatic activation
SafeControl automatically activates the stop bar and removes presence detection
On, Leave, Presence
Detection
Detection
Automatic deactivation
SafeControl automatically deactivates the first lead on segment
On, Ready, Presence
Detection
Automatic deactivation
SafeControl automatically deactivates the second lead on segment
On, Ready, Presence

Arrivals


On, Ready, Exit
90m
45m
10m
70m
L3
L2
L1
L0
S4
S3
S2
S1
Detection
Exit detection
SafeControl detects runway exit of an aircraft or vehicle
On, Ready, Idle
Detection

Incursion



The Presence detection function will be based upon two sensors: Presence sensor S1 placed approximately 70 m in front of the stopbar and the Stopbar Sensor S2 placed directly after the stopbar. The presence detection can be Idle, Exit or Presence.

When no air plane is detected the presence detection is in Idle.

If the S2 sensor gets the next detect it indicates that an air plane is Exiting the runway and the Presence state is set to exit. The exit state will remain until S1 detects, upon which the Presence state is set to Idle. Multiple Detections on S1 during the next 30 seconds will be allowed.

If the S1 sensor gets the next detect it indicates that an air plane has approached the stopbar towards the runway and the presence state is set to presence. This state will remain until S2 detects upon which the presence state sets to idle. Multiple Detections on S2 during the next 30 seconds will be allowed. When S2 detects it is checked whether the Stopbar has been turned off. If this is not the Case the Incursion State will be set indicating that the air plane has crossed the stopbar without permission. The Incursion state will remain set for 30 seconds.

The command Toggle Presence detection can be used to reset/set the presence state in case the presence logic ends in a wrong state.

1.1 Stopbar Command

Below is the stop bar command word.

Bit	Command	Bit Clear	Transition to bit Set	Comment
0	Control On	No action	Turn On SB (Ready)	Only effective when Stop bar is Off. Set the Stopbar to Ready State
1	Control Off	No action	Turn Off SB (Off)	Set the Stopbar to Off State
2	Sequence Control	No action	Toggle Sequence	If Stopbar is Off set the Stopbar to Ready If Stopbar is Ready set the Stopbar to Enter If Stopbar is Enter set the Stopbar to Leave If Stopbar is Leave set the Stopbar to Enter
3	Extend Sequence	No action	Extend time	Reload Enter or Leave Timer
4	Enable Sensor	No action	Enable Sensor	Use Sensors - default
5	Disable Sensor	No action	Disable Sensor	Disregard any Sensor inputs. Prohibits Incursion and run the Stopbar Macro in Timed mode.
6	Enable Lead On	No Action	Enable Lead On	Turn on the Lead On TCL in Off, Enter and Leave state - default
7	Disable Lead On	No Action	Disable Lead On	Do not turn on the Lead On TCL in Off, Enter and Leave state.
8	Toggle Presence Detection	No Action	Toggles Presence Detection	If Presence is detected clear the Presence state If Presence is not detected set the Presence state
9	Reset	No Action	Reset	Only effective when Stop bar is On and in a sequence. Sets the Stop bar to Ready State
10 – 15	Reserved	-	-	Read as 0

Every command is issued when bits transit form 0 to 1. When the command has been executed the control word should be set to zero. The use of a command pulse will avoid any unwanted commands to be re issued in case of link problems.

When the Modbus link is failing then the Stopbar will enter failsafe state. After such disconnect the Stopbar must be initialized in order to leave failsafe state. The initialization shall be done either by sending a Turn On or a Turn Off in order to turn the stopbar either on or off.

When the stopbar is in OFF state the Lead On segments will be controlled as set by the Segment Command. In any other case the Lead On segment will be controlled by the Stopbar Macro. In case it is not desirable to have the Lead On turn on during the sequence (e.g if all other TCL is turned off at the airport) then the Disable TCL command can be issued.

The Enter and Leave time will be configured to 45 seconds.

In case the ASP Gateway should restarted then any settings made on Enable/Disable sensor, Enable/Disable Lead On and Presence detections will be lost. The ASP Gateway will enter the default settings on these data which is: Enable sensor, Enable Lead On and Idle. The Host Control system must in this case re apply any settings made earlier.

1.2 Stopbar Status

Below is the stop bar Status word.

Bit	Status	Comment
0	ON	Bit will remain set while the Stop bar is not Off
1	Ready	Bit will remain set while the stopbar is in Ready State.
2	Enter	
3	Leave 1	
4	Leave 2	
5	Sensors Enabled	
6	Lead On Enabled	Stop bar and Lead On segments will be in failsafe.
7	Un-initialised	
8	Idle	Neither Presence nor Exiting is detected
9	Presence	Presence State
10	Exit	Exit State
11	Incursion	Detect from Incursion sensor when Stopbar macro is ON
12	Stop bar lamp fault and pattern error	Bit will be set when the stop bar has 3 or more lamp faults or at least 2 adjacent lamp faults.
13-15	(reserved)	

1.3 Stop bar error indication

In the extended stop bar function the following 3 indication exist for back indication of Stopbar Segment. Generally the Stopbar can be used operational when the stop bar is on (more than 50% lamps operational). However in Low Visibility it is recommended that no adjacent lamp fail exist (2 lamps in fail next to each other) and that the amount of failed lamps do not reach 3 lamps.

The status data of the stopbar will be available for the Host system.

1.3.1 Stopbar Segment Number of lamp in error

Error word value	Description
0..65535	The number of failed lamps in a stopbar segment.

The Stopbar segment Lamp fail indicates the number of failed lamps in the stopbar.

1.3.2 Stopbar Segment Adjacent Error

Adjacent bit value	Indication	Description
0	OK	The segment has no adjacent lamp fail.
1	Adjacent Lamp fail	The segment has at least one adjacent lamp fail

The Stopbar segment Adjacent Lamp fail indicates that at least two lamps next to each other have lamp fails.

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APPENDIX B – ADVANCED SEGMENT FUNCTIONS

1 LIGHT SEGMENT FUNCTIONS

The general light system object can be used for status monitoring of a light system such as a taxiway or runway light systems.

1.1 Segment Lamp fail

Error word value	Description
0..65535	The number of failed lamps in a light segment

The segment Lamp fail indicates the number of failed lamps in the Light segment.

1.2 Segment Adjacent Error

Adjacent bit value	Indication	Description
0	OK	The segment has no adjacent lamp fail.
1	Adjacent Lamp fail	The segment has at least one adjacent lamp fail

The light segment Adjacent Lamp fail indicates that at least two lamps next to each other have lamp fails.

APPENDIX C – 2A INTENSITY CONTROL

1 INTENSITY CONTROL

As an option it is possible to configure intensity control in the interface.

The 2A-system concept is based the traditional series circuit design but instead of controlling light intensity using the CCR it is set at a fixed current level and intensity is set by command using the communications channel made available by the ASP-system

2A intensity control implies no additional functionality compared to traditional intensity control. However, intensity control and circuit power will be handled by two separate systems namely the ASP-system and the CCR as opposed to the traditional approach where both are handled by the CCR.

The CCR will be used to:

- Turn the circuit on or off

The ASP-system will be used to:

- Set the light intensity
  - For an entire circuit, or
  - For a subset of the lights on a circuit
  - Monitor light intensity settings

The primary design objectives for the 2A-system intensity control setup is to mimic the functionality available using traditional CCR-hosted intensity control with minimal impact on the existing system’s design, function and performance yet adding valuable functionality on the application level.

The 2A intensity control provides, in addition to functionalities available using traditional intensity control, intensity control on group level, i.e. intensity can be set to different levels for different light on the same circuit. This will make it possible to co-locate for example RGL-, stopbar-, taxiway centre line- and taxiway edge lights on the same circuit.

1.1 Intensity Group Command

Each light segment has an entity within an intensity group. An intensity group is defined as the group of segments that needs to be intensity controlled in the same way.

The NCU can have many intensity groups depending on how many circuits it is controlling. It may also only have 1 intensity groups even when there are many circuits.

For each intensity groups the intensity can be set to different steps, for example, when the ASP system is used as a 3 step intensity control step 0,5,6,7 is normally used.

When changing intensity from i.e. 4 to 7 there is no need to set step 5 and 6, simply set the new wanted intensity. The intensity for the different step is set by default according to the table below. However it is possible to configure for arbitrary light intensities for the seven intensity levels.

The table below is the intensity group command word;

Command word value	Command	Description
0	Intensity step 0	Default this step will produce 0 % light output.
1	Intensity step 1	Default this step will produce 0.1% light output. This is not visible and is only used to monitor if the lamps are working without turning them on.
2	Intensity step 2	Default this step will produce 0.3% light output Normally this is not used
3	Intensity step 3	Default this step will produce 1% light output
4	Intensity step 4	Default this step will produce 3% light output
5	Intensity step 5	Default this step will produce 10% light output
6	Intensity step 6	Default this step will produce 30% light output
7	Intensity step 7	Default this step will produce 100% light output

Host System can both write and read command state, for each light intensity group.

1.2 Lamp Intensity Failure

The lamp intensity failure signal indicates whether the lamp intensity deviates from the requested intensity. When a change in intensity is requested, there will be a short time until the NCU has actually changed the light output from the lamp. The NCU will keep the previous value of the "Intensity failure" signal in this short time period. The "Intensity failure" will be set when the NCU has failed to change the intensity to the requested intensity.

State bit value	Indication	Description
0	OK	The lamp corresponds to commanded intensity
1	Intensity failure	The lamp does not correspond to commanded intensity

ASP System

Preventive Maintenance

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CONTENTS

1 Revision History ... 3
2 Scope ... 3
3 Abbreviations ... 3
4 References ... 3
5 Introduction ... 4
6 Preventive ASP-Component Maintenance ... 4
6.1 CU ... 4
6.2 SCM ... 5
6.3 SCF ... 5
6.4 LMS ... 5
6.5 SIU ... 6
6.6 MBD ... 6
6.7 SSU ... 6
6.8 SCI ... 6
6.9 SFU ... 7
6.10 LPC ... 7

1 REVISION HISTORY

Ver	Date	Remark	Author
0.1	030207	Document created.	OH
1.0	030220	Document issued.	OH
1.1	030220	Added exception for SCF.	OH

2 SCOPE

This document contains information on recommended preventive maintenance activities applicable to an ASP-System.

3 ABBREVIATIONS

ASP	Airfield Smart Power
CU	Concentrator Unit
SCM	Series Circuit Modem
SCF	Series Circuit Filter
LMS	Light Monitor and Switch unit
SIU	Sensor Interface Unit
MBD	Microwave Barrier Detector
SSU	System Switch Unit
SCI	Series Circuit Inductor
SFU	Signal Filter Unit
LPC	LMS/SIU Programming Control unit

4 REFERENCES

For details on ASP-System component characteristics and handling refer to ASP-System component user guides and/or maintenance guides.

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5 INTRODUCTION

Preventive maintenance involves the regular inspection, testing, and replacement or repair of equipment and operational systems. Much as the name implies, *preventive maintenance*, often abbreviated *PM*, refers to performing proactive maintenance in order to prevent system problems. This is contrasted to diagnostic or corrective maintenance, which is performed to correct an already-existing problem.

A preventive maintenance program can prevent breakdowns and failures through adjustment, repair, or replacement of equipment before a major breakdown or failure occurs.

Preventive maintenance for an ASP-System is not mandatory although Safegate recommends that the below described activities, or a subset thereof, are incorporated into the preventive maintenance program at whichever site where an ASP-System is installed.

6 PREVENTIVE ASP-COMPONENT MAINTENANCE

The recommended maintenance activities below and the recommended frequency at which they are carried out are based on experience and common practice.

The recommended frequency *quarterly* is equivalent to once every three months.

The recommended frequency *annually* is equivalent to once every year.

Information on how to actually perform the recommended preventive maintenance activities are not found in this document. Refer to each component's user guide and/or maintenance guide for guidance.

6.1 CU

Refer to the table below for the recommended preventive maintenance activities that apply to the CU. Note that not all items apply to all CU hardware configurations.

Recommended Preventive Maintenance Activity CU	**Recommended Frequency**
Check power supply fan for ventilation and dirt build up and clean if necessary.	Quarterly
Check case fan(s) for ventilation and dirt build up and clean fan(s) and filter if necessary.	Quarterly
Check CPU-fan for ventilation and dirt build up and replace if necessary.	Quarterly
Check detachable hard disc bay fan for ventilation and dirt build up and clean fan if necessary[1].	Annually
Clean exterior of case.	Annually
Clean exterior of monitor.	Annually

[1] Detachable hard disc bay is not included for all CU hardware configurations.

Recommended Preventive Maintenance Activity CU	Recommended Frequency
Check and clean interior, back plane and expansion cards if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Clean keyboard.	Annually
Replace case fan filter(s).	Every 2 years
Replace CPU-fan.	Every 5 years
Replace case fan(s).	Every 5 years
Replace power supply.	Every 7 years
Replace complete unit.	Every 15 years

6.2 SCM

Refer to the table below for the recommended preventive maintenance activities that apply to the SCM. Note that not all items apply to all SCM hardware configurations.

Recommended Preventive Maintenance Activity SCM	Recommended Frequency
Clean exterior of case.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Check cabinet fans for ventilation and dirt build up and clean if necessary[2].	Annually
Replace power supply.	Every 7 years
Replace complete unit.	Every 15 years

6.3 SCF

Refer to the table below for the recommended preventive maintenance activities that apply to the SCF. Note that not all items apply to all SCF hardware configurations.

Recommended Preventive Maintenance Activity SCF	Recommended Frequency
Clean exterior of case.	Annually
Check external connections and cables.	Annually
Check and clean interior if necessary.	Every 5 years
Check internal connections and cables.	Every 5 years
Replace complete unit.	Every 15 years

6.4 LMS

Refer to the table below for the recommended preventive maintenance activities that apply to the LMS.

[2] Cabinet fans only apply to the SG591883 SCM-rack.

Recommended Preventive Maintenance Activity LMS	Recommended Frequency
Reprogram configuration parameters.	Every 10 years

6.5 SIU

Refer to the table below for the recommended preventive maintenance activities that apply to the SIU.

Recommended Preventive Maintenance Activity SIU	Recommended Frequency
Reprogram configuration parameters.	Every 10 years

6.6 MBD

Refer to the table below for the recommended preventive maintenance activities that apply to the MBD.

Recommended Preventive Maintenance Activity MBD	Recommended Frequency
Clean and wax exterior of case.	Quarterly
Check alignment and adjust if necessary.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Replace complete unit.	Every 10 years

6.7 SSU

Refer to the table below for the recommended preventive maintenance activities that apply to the SSU.

Recommended Preventive Maintenance Activity SSU	Recommended Frequency
Clean exterior of case.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually
Replace power supply.	Every 7 years
Replace complete unit.	Every 15 years

6.8 SCI

Refer to the table below for the recommended preventive maintenance activities that apply to the SCI.

Recommended Preventive Maintenance Activity SCI	Recommended Frequency
Check external connections and cables.	Annually
Replace complete unit.	Every 15 years

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6.9 SFU

Refer to the table below for the recommended preventive maintenance activities that apply to the SFU.

Recommended Preventive Maintenance Activity SFU	**Recommended Frequency**
Replace complete unit.	Every 15 years

6.10 LPC

Refer to the table below for the recommended preventive maintenance activities that apply to the LPC.

Recommended Preventive Maintenance Activity LPC	**Recommended Frequency**
Replace 6.6 A_{RMS} lamps.	Annually
Check lamps in buttons and replace if necessary.	Annually
Clean exterior of case.	Annually
Check and clean interior if necessary.	Annually
Check internal connections and cables.	Annually
Check external connections and cables.	Annually

ASP-System
Troubleshooting and Maintenance

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Contents

1 Revision **3**
2 SCope **3**
3 Application **3**
4 Abbreviations **3**
5 Introduction **3**
6 Maintenance **4**
6.1 General 4
6.1.1 Replace an ASP-component 4
6.1.1.1 Replace an LMS or SIU 4
6.1.1.2 Replace an SCM 4
6.1.1.3 Replace an SCF 4
6.1.1.4 Replace an SSU 4
6.1.1.5 Replace an NCU/VCU/HCU 4
7 Troubleshooting **5**
7.1 General 5
7.1.1 Standard Troubleshooting Procedure 5
7.1.1.1 Power Supply 5
7.1.1.2 Communication 5
7.1.1.3 Accessories or other equipment 5
7.1.1.4 Specification 5
7.1.2 Advanced troubleshooting procedures 5

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1 REVISION

Author	*Date*	*Version*	*Comments*
MH	2001-11-09		Modification X0089A.

2 SCOPE

This document describes troubleshooting and maintenance of an ASP-system.

3 APPLICATION

This troubleshooting and maintenance guide is for an ASP-system with LMSs, SIUs, SCMs, SCFs, SSUs and VCUs.

4 ABBREVIATIONS

ASP	Airfield Smart Power
CCR	Constant Current Regulator
CU	Concentrator Unit
HCU	Host Concentrator Unit
LMS	Light Monitor and Switch unit
SCM	Series Circuit Modem
SIU	Sensor Interface Unit
SSU	System Switch Unit
UPS	Uninterruptible Power Supply
VCU	Vault Concentrator Unit

5 INTRODUCTION

It is assumed the reader of the guide is familiar with the ASP-system, its components and functions.

The aim of this guide is to give advice for troubleshooting problems which have temporarily caused the ASP-system to be out of operation or caused functionality performance problems. Follow the recommendations and procedures in this guide to find the reason for a problem and a resolution.

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The user manual for other specific ASP components contains procedures for troubleshooting which are not covered in this document.

6 MAINTENANCE

6.1 General

In general, ASP-components do not require any special maintenance after installation. For more information, see specific ASP component user guides.

On occasion, special requirements may be necessary for maintenance procedures as follows:

6.1.1 Replace an ASP-component

All ASP-components, excluding the SCF, must be configured according to its function in the system. When a component is replaced it must be configured in the same way.

6.1.1.1 Replace an LMS or SIU

When an LMS or SIU is replaced the new unit must be re-configured with the same parameters. For more information, see the AMT user guide regarding LMS/SIU-parameters.

6.1.1.2 Replace an SCM

When replacing an SCM-card the new unit must be re-configured with the same parameters. For more information, see the AMT user guide regarding LMS/SIU-parameters.

6.1.1.3 Replace an SCF

No special procedures are required for replacing an SCF.

6.1.1.4 Replace an SSU

No special procedures are required for replacing an SSU.

6.1.1.5 Replace an NCU/VCU/HCU

For more information, see the NCU user guide and other site specific documentation.

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7 TROUBLESHOOTING

7.1 General

The focus for this section is to troubleshoot initially at an ASP system level. The aim is to eliminate the ASP components not at fault and to identify the component at fault. Fault resolution is then continued with the identified component’s specific user guide information.

***Note**: Troubleshooting procedures for each specific ASP-component are available in specific user guides.*

The normal procedure after the faulty ASP component is localized is to replace it and carry out a more advanced testing of the faulty component. This procedure is normally carried out by Safegate personnel, with the exception of basic problems such as a faulty fuse.

7.1.1 Standard Troubleshooting Procedure

It is important to always check the following before starting any advanced troubleshooting procedures:

7.1.1.1 Power Supply

Make sure all units are on and all fuses are working. Many problems are caused due to blown fuses or power supply problems.

7.1.1.2 Communication

Make sure all communication links are working by checking cabling and contact plugs. Check equipment with LEDs, which indicate send and receive, for abnormal functionality.

7.1.1.3 Accessories or other equipment

Make sure accessories or other equipment in the system works normally, especially equipment which the ASP-system depends on for normal operation, for example, CCRs, control and UPS systems. Check with manufacturer’s documentation for correct procedures.

7.1.1.4 Specification

Make sure the ASP-system is working within its specifications, both electrically and functionally.

7.1.2 Advanced troubleshooting procedures

Advanced troubleshooting requires ASP-software and in-depth knowledge about the ASP-system design, installation and configuration. For more information or assistance, contact Safegate.

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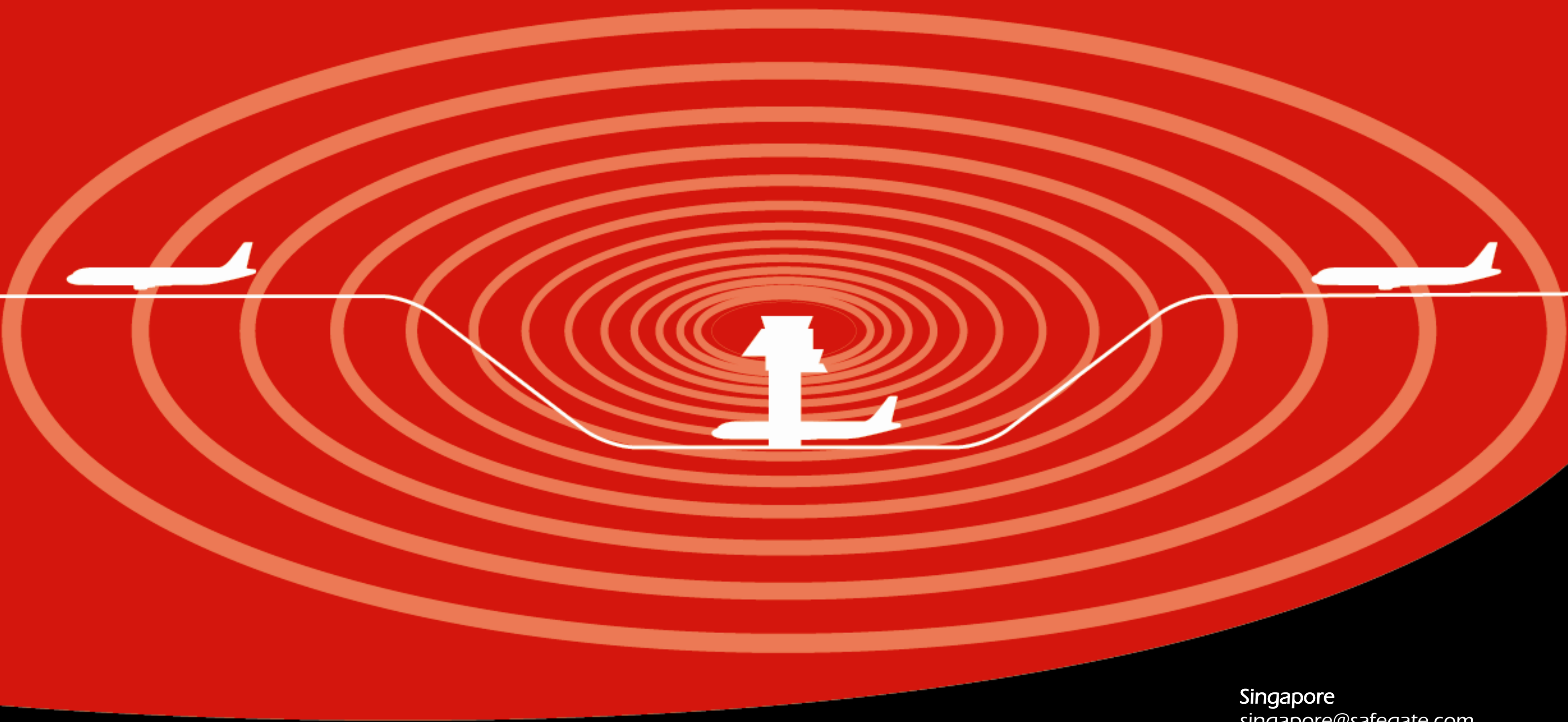

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